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Adapting Biofilter Processes to Treat Spray Painting Exhausts: Concentration and Leveling of Vapor Delivery Rates, and Enhancement of Destruction by Exhaust Recirculation

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13. ABSTRACT *(Maximum 200 words)*
The goal of this Phase II SBIR effort was to demonstrate the compatibility of a concentrator–regenerator coupled with a biofilter air pollution control process for the treatment of intermittent paint booth emissions. A field-pilot system was temporarily installed at Tyndall Air Force Base. The concentrator–regenerator was shown to work effectively in the laboratory. In the field, however, a combination of marginal loading from the paint booths and solvent sinks (indicated by a system mass balance) in the pilot unit initially produced too low a delivery rate from the concentrator/regenerator to adequately feed the biofilter on a continuous basis. When supplementary and, later, regenerated vapors became available to the biofilter, it achieved greater than 80% removal of the solvent-laden air. In instances where a constant, synthetic feed stream was supplied to the biofilter over a short [continued on p. ii]

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13. ABSTRACT (CONTINUED)

time span (within days), the biofilter removed greater than 87% of all the organics within the first 0.5 feet of bed height Air recycling at recycle ratios of 44%, 61%, 73%, and 78% provided increased removal efficiencies of 88%, 94%, 95%, and 98%, respectively. Capital costs for the concentrator–regenerator and biofilter were estimated to be $804,500 and $70,700, respectively. Yearly operating costs for the concentrator–regenerator and biofilter were estimated to be $68,700 and $5,580, respectively. Robustness, reliability, and minimal intervention are design targets for improvement, but technical feasibility of the design concept was successfully demonstrated.

EXECUTIVE SUMMARY

OBJECTIVE

The goal of this SBIR Phase 2 effort is to demonstrate the effectiveness of coupling a concentrator–regenerator system as an input buffer to a biofilter air pollution control as a process for the treatment of paint booth emissions. Such a system could allow individual paint booths to operate with their emissions being adsorbed to carbon. This carbon could then be transported to a single regenerator unit followed by the biofilter system for treatment. This concept would allow the Air Force to control costs by using one, centrally placed, abatement system for a series of small painting operations.

Biotreatment processes, such as biofiltration, are environmentally friendly, and produce only non-hazardous by-products such as water, inorganic salts, and low levels of carbon dioxide. No carbon monoxide, nitrogen oxides (NO_X), or sulfur oxides (SO_X) are produced. In addition, biotreatment processes are usually much more energy-efficient than thermal processes, since biodegradation processes take place at ambient temperatures and pressures.

The major objective of this SBIR project is to understand and establish the operating conditions necessary for effective treatment of paint solvents using the concentrator–regenerator in conjunction with the biofilter system.

BACKGROUND

The most readily applied and commercially available biological air treatment system is biofiltration. Biofiltration is a process that utilizes microorganisms immobilized in the form of a biofilm layer on an organic, porous medium such as wood chips or compost. As a contaminated air stream passes through the matrix, pollutants are transferred from the air to the biolayer and are oxidized, forming carbon dioxide, inorganic salts, and water.

A key to the success of a biofilter system is that a thriving microbial population is maintained. Numerous point sources, such as paint booths, generate transient, nonsteady-state loads. Therefore, the intermittent operation of these point source emissions may not continually provide sufficient organic loading to sustain a biofilter reactor. One potential solution to this problem is to insert a concentrator–regenerator system as a preliminary step to provide the biofilter with a constant load of organics. In general, granular activated carbon (GAC) adsorbs solvent vapors and other volatile organic compounds (VOCs) at removal efficiencies of greater than 99 percent. The adsorption capacity of GAC is higher than 10% for solvents used in spray painting operations. The GAC bed removes and stores solvents in air and can be used as a concentrator for the biofilter operations. Because GAC is an excellent microwave energy absorber, rapid and controlled regeneration of saturated carbon is possible to supply a constant stream of air containing a steady concentration of solvents to a biofilter.

SCOPE

To understand and establish the operating conditions necessary for effective treatment of paint booth emissions using a dual concentrator–regenerator/biofilter treatment system, numerous major tasks must be conducted. The major tasks of the project are to (1) establish the ability of the dual treatment systems to efficiently perform in the field; (2) perform a mass balance across both systems to determine the capture and treatment efficiencies; (3) recycle air through the biofilter to improve upon the system's performance to eliminate an artificially generated organic load; and (4) establish the cost-effectiveness of the dual-phase treatment system.

METHODOLOGY

Concentrator–Regenerator/Biofilter Setup

This experimental study required the scale-up of the concentrator–regenerator system (from a bench-scale system) so that it can effectively work in conjunction with the biofilter treatment system. The major components of the concentrator–regenerator system included the adsorber, microwave regenerator, compressor, pneumatic carbon transfer system, system monitoring/control hardware and software, the carbon, and the storage vessels. Envirogen installed a predesigned, prefabricated P600 series biofilter at Tyndall AFB in series with the concentrator–regenerator system. The entire biofilter system is composed of a control panel, blower, humidification chamber, and a vessel that sits atop a trailer. The concentrator–regenerator was tied into the paint booth facility via air ducting. The biofilter is designed to vent directly to the atmosphere.

On-site air analysis of total organic concentrations was performed using one Eagle™ EM-700 (Irvine, California) and two Thermo Environmental Instruments Model 51 total hydrocarbon analyzers that sampled continuously. The analyzers measured air concentrations at the inlet of the adsorber, before the biofilter (after storage tanks), and after the biofilter reactor. The instruments used methane as a calibration gas standard. The data obtained from the analyzers were automatically logged into a data acquisition system. In addition, grab samples of air were obtained on a periodic basis for off-site analysis to speciate the contaminants in the air.

TEST DESCRIPTION

TASK 1: Establish the Ability of the Dual Treatment Systems to Efficiently Perform

The ability of the concentrator–regenerator to work in conjunction with the biofilter treatment system had first to be established. To maintain a thriving microbial population on the biofilter media, a constant source of organics (greater than 90 ppmv as methane carbon equivalents) must be supplied to the biofilter. To confirm that this concept could work in the field, detailed experiments were conducted in the lab at the bench level to assess the ability of the concentrator–regenerator to treat paint emissions. In addition, the capabilities of the concentrator–regenerator were also tested for the treatment of solvents in water-saturated streams. From these bench-scale studies,

predictions of the concentrator–regenerator's performance in the field guided the design of the pilot-scale system.

Once the system setup was complete in the field, a side stream of contaminants from the paint booth was directed through a blower to the concentrator (carbon adsorber). With sufficient loading of the concentrator (based on theoretical calculations of mass loading from the paint booth), the carbon was regenerated and the emissions were fed to the storage tanks. The contents of the tanks were bled to the biofilter with dilution air. This study examined the ability of the storage tanks to provide a steady load to the biofilter and the ability of the biofilter to effectively treat the contaminants.

TASK 2: Perform a Mass Balance Across Both Systems to Determine the Capture and Treatment Efficiency of the Dual Systems

Performing a mass balance allows for a complete inventory of all artificially introduced solvents so that capture efficiencies, regeneration efficiencies, and destruction efficiencies can be calculated for the concentrator, regenerator, and biofilter, respectively. With the blower from the paint booth turned on (pulling in ambient air only), a peristaltic pump was used to slowly inject mixed solvent onto a wick located upstream of the blower and downstream of the carbon hopper unit. A wick was used so that complete evaporation into the blower discharge air would occur before entering the carbon adsorber. Analyzers measured the total hydrocarbon concentrations entering and exiting the carbon adsorber allowing capture efficiency across the adsorber to be calculated. From the adsorber, carbon was regenerated into the storage tanks over a 20-day period. We measured the contaminant concentrations exiting the storage tanks and entering the biofilter. From these concentrations and the known flowrate, the mass of contaminant in the tanks could be calculated. From the storage tanks, contaminants entered the biofilter and were degraded. Destruction efficiency was calculated across the biofilter by measuring inlet and outlet concentrations using the two hydrocarbon analyzers. With the concentration and flow going into and out of the biofilter known, a mass balance for the biofilter over time could then be calculated, completing the mass balance across the dual systems.

TASK 3: Recycle Air Through the Biofilter to Improve Upon the System's Performance to Eliminate an Artificially Generated Organic Load

Recycling the air in a biofilter can conceivably produce better degradation within the biofilter because of the longer gas residence times. However, to demonstrate this fact we had first to establish a critical mass loading into the biofilter. To establish the critical mass loading rate, a solvent (MEK) was introduced artificially to the storage tanks in a liquid form, along with some pure nitrogen gas. The addition of the nitrogen gas to the storage tanks agitated the air inside the tanks, causing the liquid solvent to vaporize. Increasing concentrations of solvent (thus increasing loads) were introduced to the biofilter reactor (flowrate remaining the same). Spot measurements, using two hydrocarbon analyzers, were obtained along the length of the biofilter to establish the loading rate that produced breakthrough at the top of the biofilter.

Once a critical loading rate was established, the reactor design was changed so that a portion of the effluent air from the biofilter was recycled to the inlet of the biofilter for further treatment. The biofilter was operated under conditions that exceeded the critical loading to produce an effluent concentration 10% of the influent. The two hydrocarbon analyzers were placed at the inlet and effluent lines of the biofilter for solvent concentration measurements. A volumetric portion of the effluent was then recycled back to the biofilter and an overall destruction efficiency could be calculated. The experiment was repeated several times at differing volumetric recycling ratios (returned air flowrate/total air flowrate) to determine the effects that recycling has on overall biofilter performance.

TASK 4: Establish the Cost-Effectiveness of the Dual-Phase Treatment System

In this study, a sidestream of air (2,000 scfm) from one paint booth was utilized to feed the concentrator–regenerator/biofilter system. The total airflow available from the paint booth was actually 30,000 scfm. Assuming this type of flow is to be seen on a consistent basis, then scaling up of the carbon bed and regeneration systems would be required. Since the concentrator–regenerator provided organics to storage tanks that were bled off to the biofilter, the actual biofilter design specifications (in this case) remained the same, and no further scaling was necessary. Capital costs are developed for both the concentrator–regenerator and biofilter. System mobilization, installation, and up-front training costs are included. Operating costs for the dual systems are also provided. For the concentrator–regenerator system, the two major operating costs are the electricity demand and the amount of operator attention required. Costs associated with system maintenance, including various costs for replacement parts, are included. Biofilter operating costs include operator attention hours, electricity demand, and water consumption. Finally, a Net Present Value is calculated for the combined system.

RESULTS

TASK 1: Establish the Ability of the Dual Treatment Systems to Efficiently Perform

Operation of the concentrator–regenerator was shown to work in the laboratory, allowing for scale up into the field. At the host site, it was discovered that insufficient loading existed from the paint booths to adequately feed the biofilter reactor on a continuous basis. The initial pilot-scale design of the concentrator–regenerator was constructed in the field, which proved to be overly optimistic. Much of the projected experimental effort was expended in refinement of this unit—system-unique software that operated the carbon concentrator–regenerator was reprogrammed several times to incorporate additional capabilities as the need for them became evident; several parts proved to have been underdesigned and required upgrading; others were determined in use not to be necessary and replaced; some of the magnetrons, transformers, flowmeters, and valves required attention or replacement.

When the feed system was finally able to deliver steady-state loads of regenerated gases to the biofilter, it achieved greater than 80% removal of organics from the solvent-laden air. To keep the biofilter acclimated to a solvent-laden air stream, an artificial load of air containing MEK, toluene, and 2-pentanone was occasionally fed to the biofilter. In instances where this feeding occurred over a short time span (within days), the microbial population acclimated to the solvents and generally removed greater than 87% of all the solvents within the first 0.5 feet of bed height.

TASK 2: Perform a Mass Balance Across Both Systems to Determine the Capture-and-Treatment Efficiency of the Dual Systems

In an effort to demonstrate the ability of the carbon concentrator–regenerator to effectively work in conjunction with the biofilter, an artificial load was introduced at the beginning of the treatment train. This artificial load was created to supplement the inadequate loading that was transmitted from the paint booth. The solvents MEK, toluene, and 2-pentanone were introduced downstream of the paint booth blower (pulling in ambient air) and upstream of the carbon adsorber unit, at typical spray paint booth loading rates. We established that 4674 g as carbon entered the adsorber and 396 g exited the adsorber, providing a capture efficiency of 92%. The loaded carbon was regenerated for 40 hours and 647 g (of 4278 g) was regenerated off the carbon. Completing the initial mass balance, 85% of the 647 g that was regenerated and fed to the biofilter was degraded.

Off-site laboratory analysis of pre- and post-regenerated carbon demonstrated that the efficiency of regeneration was much higher (at least 91%) than indicated by the 647 g value. Accordingly we suspected that a much larger fraction of the total amount of contaminant on the carbon was regenerated but lost. Of 4278 g adsorbed, 647 g was recovered after regeneration and 385 g (based on laboratory estimates) remained in the carbon bed, leaving 3246 g unaccounted for. In addition to system holdup in the piping and tanks (which would become background in steady-state processes), significant sinks were eventually identified in a water-recovery tank, a vacuum pump, and sections of PVC pipe used in constructing the concentrator–regenerator system and transfer lines. These three elements were not replaced during this study, but none of them should appear in subsequent designs for solvent-handling devices.

TASK 3: Recycle Air Through the Biofilter to Improve Upon the System's Performance to Eliminate an Artificially Generated Organic Load

For the recycling experiments, a critical load was established at a concentration of 2000 ppmv (984 mg m^{-3}) of MEK as methane equivalents. This concentration provides an overall loading rate of 9.8 g m^{-3} hr^{-1} across the entire filter bed (considered the critical load). As a baseline for the recycling experiment study, the reactor was fed at this critical load with no recycling of air. Without recycling of the air, 82% of the MEK-laden air was degraded. After establishing this baseline, numerous experiments at different recycle ratios were conducted. These ratios were 44%, 61%, 73%, and 78%, providing removal efficiencies of 88%, 94%, 95%, and 98%, respectively. As was expected, there was a

direct correlation between the increasing recycle ratio and the removal efficiency. For the critical load used in these experiments, oxygen limitations appear not to be a factor and daughter products were not developed that inhibited or limited system performance.

TASK 4: Establish the Cost-Effectiveness of the Dual-Phase Treatment System

Capital costs for the concentrator–regenerator and biofilter are estimated to be \$804,500 and \$70,700, respectively. Yearly operating costs for the concentrator–regenerator and biofilter are estimated to be \$68,700 and \$5,580, respectively. Assuming a 5-year project life, an interest/inflation rate of 4 percent and a discount rate of 12 percent, at 100 percent on-line, the combined system Net Present Value was calculated to be \$1.17 million.

CONCLUSIONS

For efficient and economical treatment of high volumes of intermittent volatile organic compound and hazardous air pollutant emissions using biofiltration, some mode of concentration is required both to reduce the volume of air treated, and to provide a more even organic load to the biofilter. The results of this study after shakedown of the concentrator–regenerator was completed show clearly that a concentrator that levels the feed rate followed by a biofilter is a technically feasible solution for air pollution control from a spray paint booth operation. Several opportunities for design improvement surfaced during the course of this study, and these may lead to improvements in cost effectiveness. Additionally, extension of the design as a central treatment facility that accepts portable adsorbers charged at remote facilities would enhance cost effectiveness.

RECOMMENDATIONS

It would be useful to repeat the mass balance experiment and vary the amount of energy required by the microwave regenerator to regenerate the carbon effectively. This would provide a possible cost savings if it could be determined that only two magnetrons (as opposed to four) are required to effectively regenerate the carbon.

Additional experiments are required to confirm a critical loading rate to the biofilter. A critical load was determined in this study, but this particular loading rate may have been only an intermediate step towards larger mass removal as the microbes acclimated to the solvent of interest. Longer operation of the system at this critical load would confirm this point. Recycling of the air proved effective for this application in the short term. Longer periods of biofilter operation in recycle mode could see reduced performance if the loading increases sufficiently that oxygen limitations become critical. Only a single component (MEK) was used for the recycling study. Using multiple-component streams may promote oxygen limitation, change the bed conditions (pH, microbe type, etc.), and create daughter products. Extensive further research is required to assess the variables ssociated with recycling the air stream in a biofilter.

PREFACE

This report was prepared by Envirogen, Inc., Lawrenceville, N.J., 08648 and CHA Corporation, Laramie, Wyoming, 82070, under Contract Number F33615-98-C-5854 for the Air Force Research Laboratory (AFRL/MLQ), 139 Barnes Drive, Tyndall AFB, Florida 32403-5323.

This report describes work performed from July 1998 to January 2001. The Air Force technical program monitors were Capt Gus Fadel and Dr. Joe Wander.

We gratefully acknowledge the enthusiastic cooperation of the Paint Booth Facilities Operation at Tyndall Air Force Base, without whose help this study would not have been possible.

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LIST OF ABBREVIATIONS

BSM.................................	basal salts medium
CAAA................................	Clean Air Act Amendments
CO_2....................................	carbon dioxide
cfm....................................	cubic feet per minute
FID...................................	flame ionization detector
GC....................................	gas chromatograph
GC/MS...............................	gas chromatography/mass spectroscopy
HAP....................................	hazardous air pollutant
HCl..................................	hydrochloric acid
m,*p*-Xyl...........................	*meta*-xylene and *para*-xylene, respectively
MC....................................	methylene chloride
MEK.................................	methyl ethyl ketone
min....................................	minute[s]
µL.....................................	microliter[s]
mL......................................	milliliter[s]
n-BA.................................	*n*-butyl acetate
nm.....................................	nanometer[s]
NO_2..................................	nitrogen dioxide
NO_X..................................	nitrogen oxides
OSHA................................	Occupational Safety and Health Administration
o-Xyl................................	*ortho*-xylene
PID....................................	photoionization detector
POTW...............................	Publicly Owned Treatment Works
ppmv.................................	parts per million by volume
RT.....................................	vapor retention (contact) time
SBIR.................................	Small Business Innovation Research
sec....................................	second[s]
SO_X..................................	sulfur oxides
UV.....................................	ultraviolet
VOC..................................	volatile organic compound
v/v......................................	volume percent
w/w....................................	weight percent

I. INTRODUCTION

A. OBJECTIVE

The goal of this Small Business Innovative Research (SBIR) Phase 2 effort is to develop a cost-effective, efficient, dual-phase concentrator and regenerator/biofiltration process to treat non-chlorinated hazardous air pollutants (HAPs) emitted during painting operations, such as MEK and toluene. Typical spray paint booth emissions have been shown to be readily treatable using biofilter treatment systems (Wander, 1995; Paff and Bosilovich, 1995). However, if constant organic loading is not introduced to a biofilter, an effective microbial population may not be maintained. Typical spray paint booths provide a transient, unsteady-state organic load. Thus, the addition of a concentrator provided upstream of a biofilter can eliminate these unsteady loading conditions so that the biofilter microbial population can thrive.

Existing treatment options for paint booth emissions are often energy-inefficient, and therefore very expensive, in the low-concentration range. A cost-effective air treatment option for mixed solvents, especially for the low-concentration range, would be extremely beneficial to the Air Force and the other Armed Services, as well as the pollution control field in general. By introducing a low-concentration stream of contaminants to an upstream adsorber, sufficient loads could be continually supplied to a downstream biofilter to effectively maintain removal performance. Such a dual-phase system could allow multiple spray paint booths to operate independently, feeding the adsorber material. This adsorber material could then be transported to a centralized location where it could be regenerated and fed to the biofilter. This would allow the Air Force to spend capital on one biofilter system to treat all of the air emissions from paint booths throughout the base, rather than multiple abatement systems per paint booth activity.

An important objective of this SBIR project is to understand and establish the operating conditions necessary to treat VOC and HAP emissions generated intermittently from a spray paint booth located at Tyndall AFB (Panama City, Florida), as a representative application to a Department of Defense coating operation. Biological treatment of such a transient, nonsteady-state load of organics requires that some sort of concentrator–regenerator/biofilter treatment system be implemented. This experiment will provide insight as to the applicability of such a treatment system to spray paint booth operations. The establishment of essential operating parameters and vital performance results will allow for the eventual scale-up of the system.

B. BACKGROUND

The treatment of contaminated air [volatile organic compounds (VOCs) and hazardous air pollutants (HAPs)] has received increased attention in recent years, largely as a consequence of the 1990 Clean Air Act Amendments (CAAA). VOCs affect the nitrogen dioxide (NO_2) photolytic cycle, and also contribute to the formation of ground-level ozone and other oxidants, the major components of photochemical smog (Wark and Warner, 1981). The CAAA require a significant reduction in HAPs released from major emission sources. There are 188 HAPs currently listed under Title III of the CAAA targeted for reduction, including the common paint solvents toluene, xylenes, and methyl ethyl ketone (MEK) (Driscoll, 1988).

The Air Force, as well as the Armed Forces and aerospace industry in general, has significant air discharge problems that must be addressed to meet the requirements of the 1990 CAAA (Alex, Graziano, and Ritts, 1996; Bauer and Canfield, 1996). For the aerospace industry, major sources of HAPs and VOCs include emissions from spray-paint booths during painting, coating, and stripping operations. Paints typically contain toluene, xylene, and MEK, all of which are listed HAPs [January 5, 1996, issue of *Defense CLEANUP* (Vol. 7, No. 1)]. The vapor flowrate from large spray-paint hangars can be 100,000 cubic feet per minute (cfm) or greater (Alex, Graziano, and Ritts, 1996; Bauer and Canfield, 1996). Treatment of these large air flowrates using conventional abatement technologies is very costly, since the capital costs of air pollution control systems is typically proportional to the volumetric air flowrate. Therefore, the Air Force and aerospace industry are investigating ways of reducing the volumetric air flowrate from paint booths through air re-circulation and split-flow techniques (Wander, *et al.*, 2001, 2001a; LaPuma, 1998; Alex, Graziano, and Ritts, 1996; Bauer and Canfield, 1996; Hughes, *et al.*, 1993). Combining operations, *i.e.*, emissions from two or more booths, is also being investigated as a means of reducing air treatment costs (Bauer and Canfield, 1996).

Conventional treatment options for paint booth exhausts include (1) catalytic thermal oxidation; (2) fixed-bed carbon adsorption; (3) fluidized-bed adsorption; (4) liquid scrubbing; (5) photocatalytic oxidation; (6) recuperative, regenerative, and straight thermal oxidation; and (7) UV/ozonation (Alex, Graziano, and Ritts, 1996). However, there is also significant interest in the use of more cost-effective alternative biological technologies for treatment of these streams. Biotreatment of contaminated air is a relatively recent development in the United States. Traditional vapor scrubbing, thermal incineration, catalytic incineration, and adsorption onto activated carbon have all been used to treat airborne contaminants in the past. However, all these methods are potentially more expensive than biotreatment (Chetty, Dyer, and Mulholland, 1992; Dharmavaram, 1991). In addition to economic issues, another drawback of both traditional vapor scrubbing and adsorption to activated carbon is that these methods do not destroy the toxic contaminants, but merely transfer them from one medium (air) to another (liquid or solid). Further processing is necessary to destroy the contaminants. Biotreatment processes are environmentally friendly, and produce only non-hazardous by-products such as additional biomass, water, and low levels of carbon dioxide (CO_2).

No carbon monoxide, NO_X, SO_X, or thermal pollution are produced. In addition, biotreatment processes are generally much more energy-efficient than thermal processes, since biodegradation processes take place at ambient temperatures and pressures.

The most readily applied and commercially available biological air treatment system is biofiltration (Figures 1 and 2, Leson and Winer, 1991; Devinny *et al*., 1999). Biofiltration is a process that utilizes microorganisms immobilized in the form of a biofilm layer on an organic, porous filter packing material such as wood chips or compost. As a contaminated vapor stream passes through the filter bed, pollutants are transferred from the vapor to the biolayer and are oxidized, forming carbon dioxide and water, or, in the case of odors, are transformed into less- or non-odorous compounds. Biofiltration has been used in Europe for over 30 years to control odorous air emissions (Leson and Winer, 1991; Devinny *et al*., 1999). Biofilters have also been used in the United States to treat hydrogen sulfide, mercaptans, alcohols, and other odor-causing air-borne contaminants emitted from wastewater treatment plants, industrial process streams, and composting facilities (Allen and Yang, 1992; Leson *et al*., 1993; Kuter *et al*., 1993). Recent advances in biofilter technology have expanded the range of treatable target compounds to include many VOCs and HAPs as well (Leson and Winer, 1991; Togna *et al*., 1993; Ergas, Schroeder, and Chang, 1993; Yavorsky, 1993; Devinny *et al*., 1999), including spray-paint exhausts (Wander, 1995; Paff and Bosilovich, 1995). Biofilters can be designed as enclosed (Figure 1) or open (Figure 2) systems. However, open-bed biofilters are typically less expensive than enclosed units. The simplest form of "biofilter" is the soil bed, where a horizontal network of perforated pipe is placed about two to three feet below the ground (Bohn, 1992). Vapor contaminants are pumped through the piping, flow upward through the soil pores, and are oxidized by microorganisms present within the soil. However, efficient and reliable biofiltration often requires a more controlled environment than typically found within soil beds. Control of bed moisture content and pH is necessary if the microorganisms responsible for biodegradation are to function efficiently.

A key to the success of a biofilter system is that a thriving microbial population is maintained. Numerous point source emissions, such as paint booths, generate transient, nonsteady-state loads. Therefore, the intermittent operation of these point source emissions may not provide sufficient organic loading to sustain a biofilter reactor. One potential solution to this problem is to provide a concentrator–regenerator system as a preliminary step to provide the biofilter with a constant load of organics. In general, granular activated carbon (GAC) adsorbs solvent vapors and other volatile organic compounds (VOCs) at removal efficiencies of greater than 99 percent. The adsorption capacity of GAC is higher than 10% for solvents used in spray-painting operations. The GAC bed removes and stores solvents in air and can be used as a concentrator for the biofilter operations. Because GAC is an excellent microwave energy absorber, rapid and controlled regeneration of saturated carbon is possible to supply a constant stream of air containing a steady concentration of solvents to a biofilter. Such a process is not unique. There are other commercial processes that use resin beads and microwave heating to capture and concentrate organic vapors in similar manner. However, the effluent air steam is not fed to a biofilter but is burned.

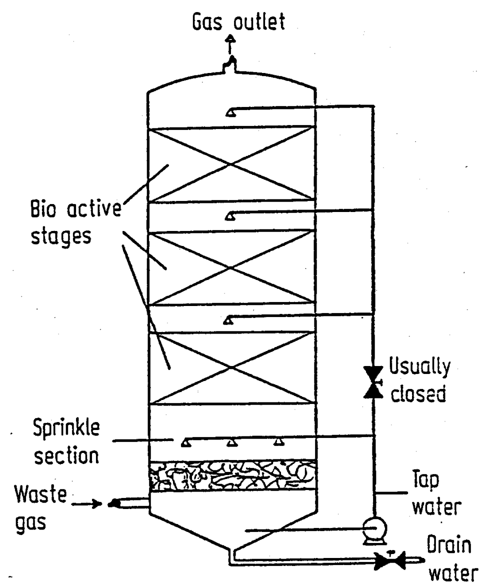


Figure 1. Enclosed biofilter schematic (from Ottengraf *et al.*, 1986).

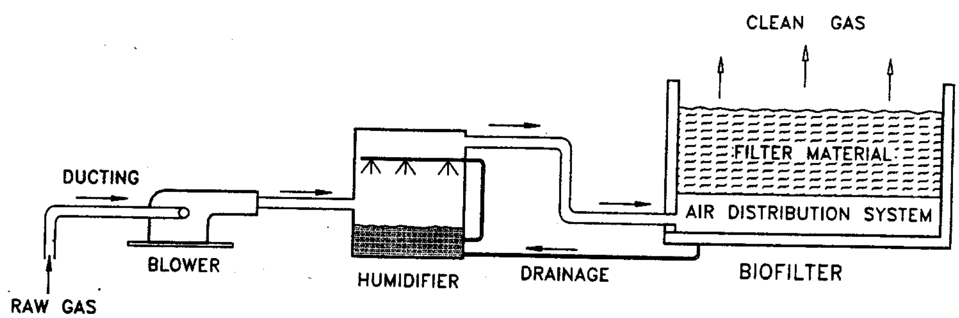


Figure 2. Open-bed biofilter schematic (from Leson and Winer, 1991).

C. SCOPE

The objective of this Phase 2 SBIR project was to understand and establish the operating conditions necessary for effective treatment of paint spray-booth emissions using a dual concentrator–regenerator/biofilter treatment system. There were three major tasks of the Phase 2 SBIR project:

1. establish the ability of the dual treatment systems to efficiently perform;
2. perform a mass balance across both systems to determine the capture-and-treatment efficiency of the dual systems;
3. recycle air through the biofilter to improve upon the system's performance to eliminate an artificially generated organic load; and
4. evaluate the cost-effectiveness of the dual-phase treatment system.

II. METHODOLOGY

A. CONCENTRATOR–REGENERATOR SYSTEM DESIGN AND CONSTRUCTION

A major task of this experimental study was to scale-up the concentrator–regenerator system (from a bench-scale system) so that it can effectively work in conjunction with the biofilter treatment system. The manufacturer (CHA Corporation, Laramie, Wyoming) of the concentrator–regenerator required that numerous design calculations and reiterations be conducted to ensure the dual-phase system works effectively together. Calculations for the adsorber hopper and main vessel, cyclone, and storage tank sizing are presented.

The major components of the concentrator–regenerator system include the adsorber, microwave regenerator, compressor, pneumatic carbon transfer system, system monitoring/control hardware and software, the carbon, and the storage vessels (Figure 3).

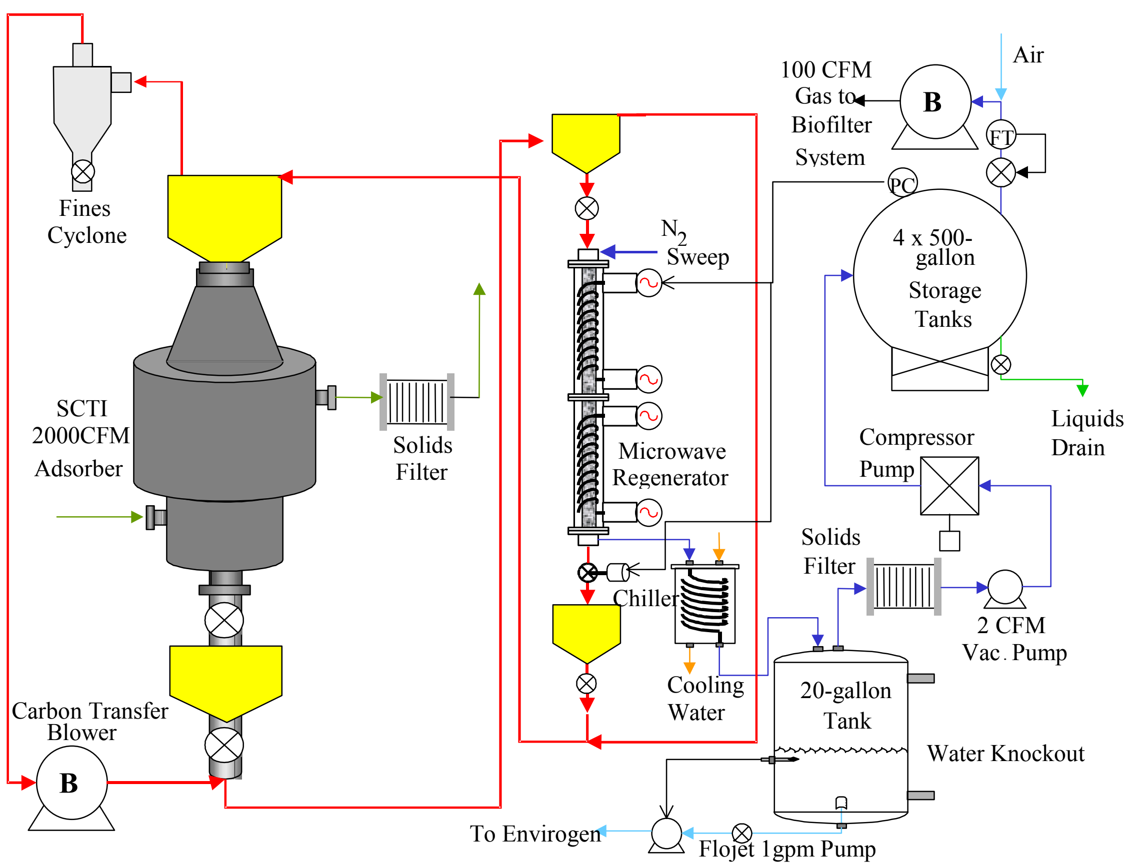


Figure 3. Schematic of the concentrator–regenerator system.

The GAC moving-bed adsorber (Figures 4–8) continuously treats a ventilated air stream (2,000 SCFM) containing solvents from spray-painting operations. This adsorber is a two-stage radial apparatus. In the adsorber, adsorption onto the GAC removes the solvents from the ventilation air. The carbon adsorbent serves as a solvent-vapor concentrator in this type of process. It removes the spray paint solvent vapors from the

large air steam, and concentrates them into a smaller stream that is more economically treated. The concentrated stream produced during regeneration of used GAC usually has

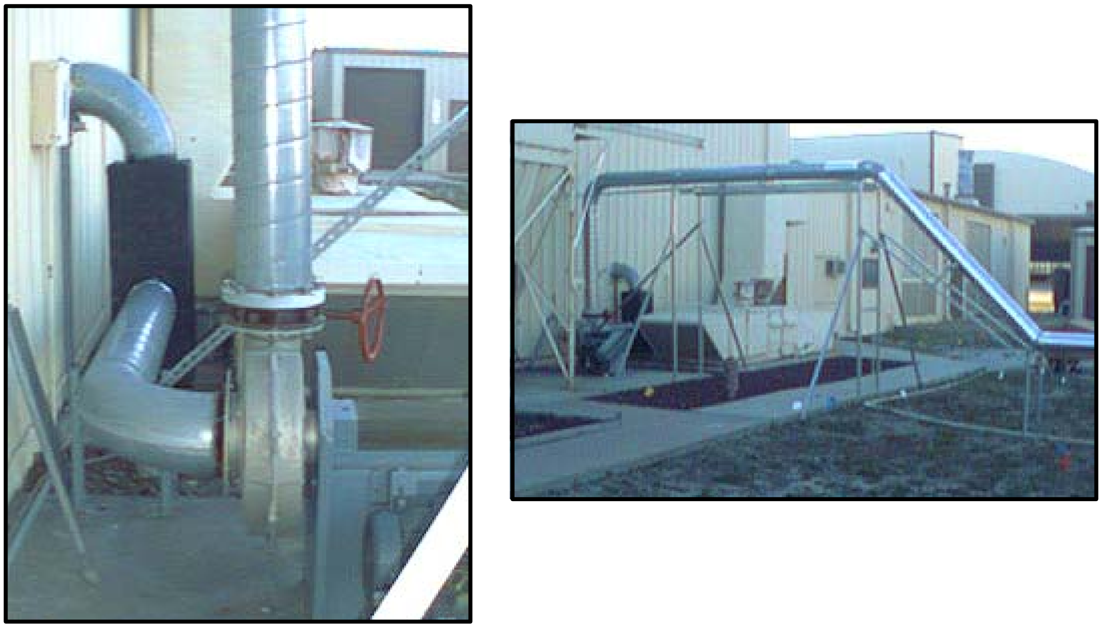


Figure 4. The ductwork from the paint booth and the 2000-CFM blower.

Figure 5. The adsorber vessel before the addition of the sidewalls and hoppers.

a flow that is less than 1% of the flow of the original contaminated air stream. The GAC

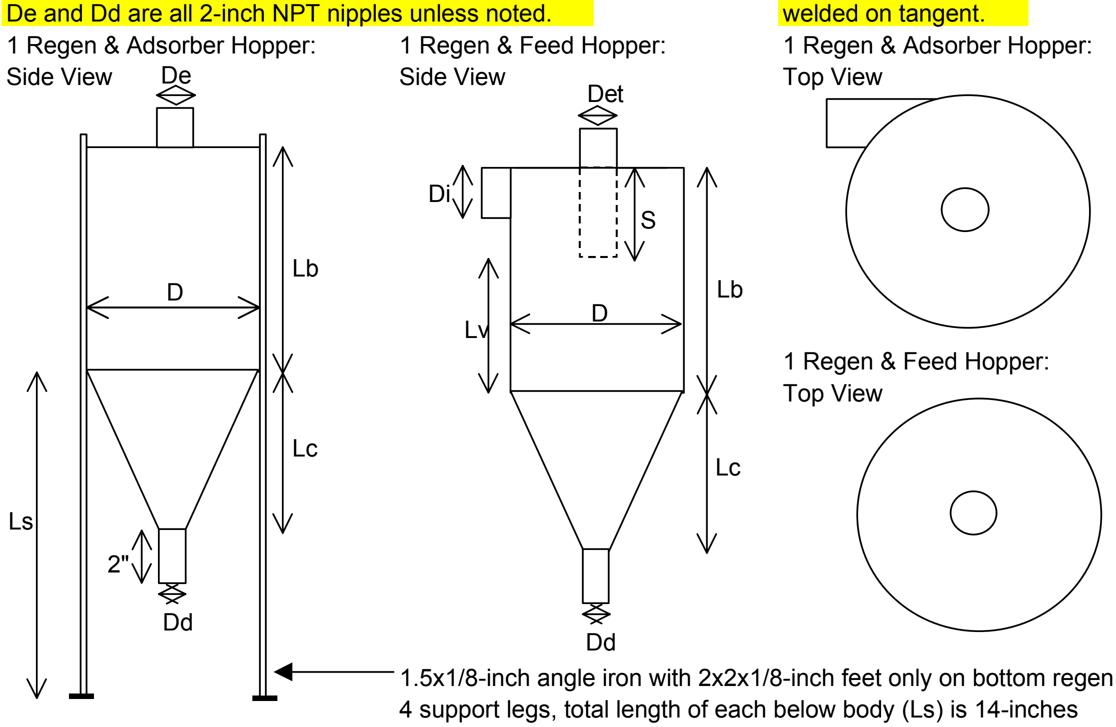
is periodically fed through the adsorption unit via a feed hopper at the top and travels downward.

		Adsorber Hopper	Feed Hopper	Regen. Hoppers, (2)
Height of Cylinder	Lb	1 ft	1.25 ft	0.75 ft
Hight of Cone	Lc	1.4 ft	1.4 ft	1 ft
Hopper Diameter	D	3.34 ft	3.34 ft	2.38 ft
Weight of Activated Carbon		425 lb	425 lb	106.25 lb
Density of Activated Carbon		30.5 lb/ft^3	30.5 lb/ft3	30.5 lb/ft^3
Volume of Activated Carbon		13.93 ft^3	13.93 ft3	3.48 ft^3
Total Hopper Height		2.40 ft	2.65 ft	1.75 ft
Actual Hopper Volume		15.70 ft^3	17.89 ft3	5.88 ft^3

		Feed Hopper	Regen. Hopper
Height of Gas Exit Votex in Hopper	S	4 in	4 in
Height of Hopper Cylinder	Lb	15 in	9 in
Height of Hopper Cylinder below Outlet Vortex	Lv	11 in	5 in
Volume of Cylinder below Vortex		8.02 ft^3	1.86 ft^3
Total Hopper Volume below Vortex		14.97 ft^3	4.39 ft^3

The diameter of S = 4 in. Det is 4 in. diameter NPT nipples.
De and Dd are all 2-inch NPT nipples unless noted.

Di is 2 in. NPT nipples welded on tangent.



Unit	Quantity	Note:
Regen Hopper	2	Only one regen hopper requires a vortex (S) and a gas inlet (Di).
Adsorber Hopper	1	Requires **no** gas exit vortex (S) or gas inlet (Di).
Feed Hopper	1	With gas exit vortex (S) and gas inlet (Di).

Material of construction: 304 S.S. .020" thickness

Figure 6. Hopper fabrication specifications.

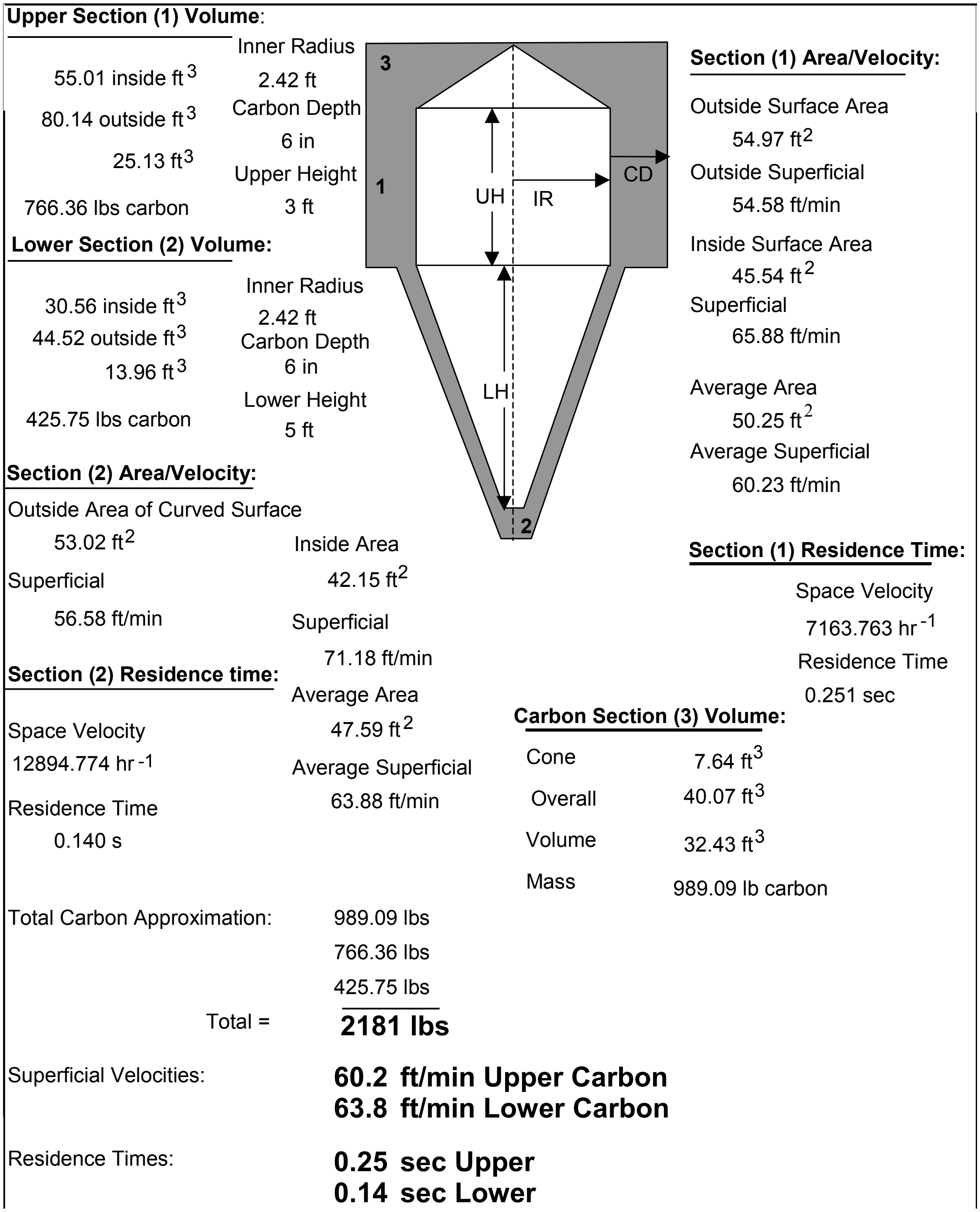


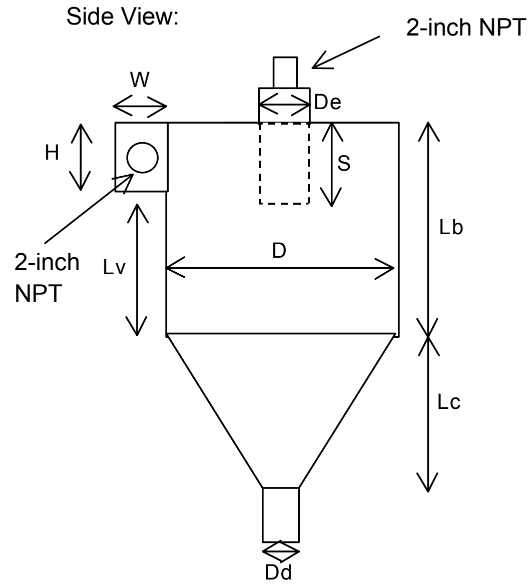
Figure 7. Design specifications for the adsorber vessel of the system.

Figure 8. The finished adsorber with the carbon hoppers secured (side paneling around the vessel) and the completed ductwork from the paint booth building.

The used GAC exits through a rotating star valve at the base of the adsorber and regenerated GAC is fed into the top of the absorber. The saturated carbon is transported to the top of the microwave GAC regenerator by a pneumatic carbon transfer system. The conveyor air is passed through a cyclone to remove any entrained solid particles during carbon transfer (store >0.5-µm carbon fines, Figure 9).

The solvent-loaded GAC is fed into the regenerator by a feed hopper at the top of the regeneration system (Figure 10). Regenerated GAC exits through a rotary valve at the base of the regenerator. The regenerator operates as a moving bed and regenerates the saturated GAC via microwave energy. The basis of the microwave regenerator design is a tee reactor in which a 2.36-inch quartz tube is housed within a 5-inch aluminum reactor body. Microwaves are supplied by home oven magnetrons and transmitted to the saturated carbon flowing within the quartz tube by a launcher, a waveguide and, finally, a ¼-inch diameter copper helix that is wrapped around the length of the quartz reactor tube. The copper helix evenly distributes the microwave energy along the length of the quartz reactor tube and promotes consistent solvent desorption. The microwave regenerator has four microwave inputs. Each microwave system includes a magnetron, launcher, directional coupler, adjustable short, power supply, and a short section of 340 waveguide

Diameter	D	14	in.
Inlet Height	H	7	in.
Inlet Width	W	3.5	in.
Exit Diameter	De	7	in.
Length of Vortex	S	8.4	in.
Body Length	Lb	24.5	in.
Cone Length	Lc	28	in.
Dust Outlet	Dd	2	in. NPT
Total Body Length		4.4	ft



Material of construction: 304 S.S. .020" thickness

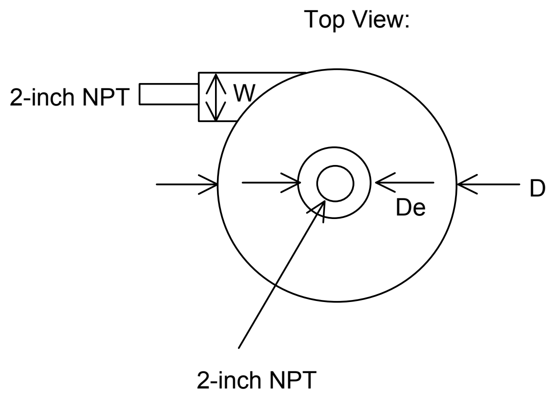


Figure 9. Cyclone fabrication drawing.

with rectangular flanges. The microwaves cause the solvents to rapidly desorb from the GAC and return to the vapor phase.

The desorbed solvent is removed from the regenerator by nitrogen gas sweep. In this double-tee reactor with central gas porting, the nitrogen sweep gas enters the system in two locations and exits from both ends as well as a 2-inch central gas exit port. The gas porting is designed to remove the desorbed solvent quickly from the reactor so that re-adsorption does not occur.

After the nitrogen/solvent gas mixture exits the microwave regenerator it passes through a chiller/water knockout tank (Figure 11). The knockout tank can drop out 67% of the water removed from the saturated carbon during regeneration. A 20-gallon tank and a float level controller are used for the water knockout. This water is added to the Envirogen water supply for either the humidifier or the biofilter. After the majority of the

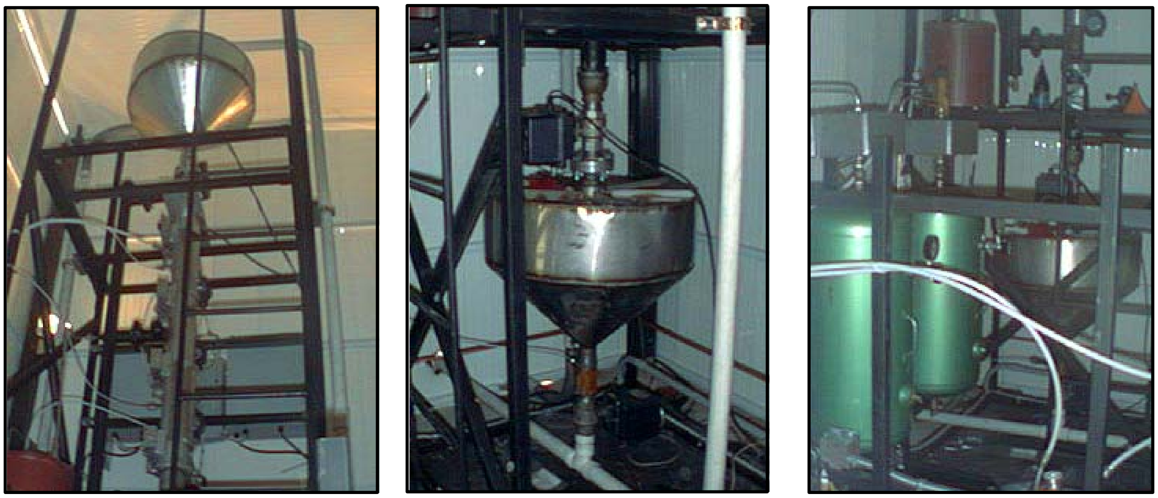


Figure 10. Regeneration equipment: microwave regenerator, carbon hoppers, and water knockouts.

Figure 11. Close-up view of the water knockout tanks.

water has been removed, the gas exits the knockout tank and passes through a solids filter that protects the vacuum pump and compressor.

The small nitrogen stream, 1.0 SCFM, containing a high concentration of solvent is compressed into four 500-gallon storage tanks (Figure 12). These tanks allow for a continuous feed to the biofilter because regeneration is periodic rather than continuous.

Figure 12. Four tanks for sweep gas storage.

The storage section of the system is in place to supply continuous concentrated solvent (90 ppm methane equivalent in 100 CFM) to the Envirogen biofilter. A design worksheet was used to determine the necessary number of storage tanks (Figure 13).

Figure 13 shows that with a storage tank operating pressure of 150 psig, approximately four 500-gallon storage tanks will be necessary to store one week’s supply of regeneration gas. Additionally, the four storage tanks will be capable of continuously supplying solvent to the biofilter for a week in case of a paint operation shutdown. This worksheet is also useful to provide cycling information for the storage system so that the time necessary to replenish the tanks can be predicted. Five-hundred-gallon propane tanks are adequate for this gas storage.

A small stream of solvent-laden nitrogen is withdrawn from the storage tanks and combined with 100 SCFM of ambient air to supply solvent vapor to the biofilter. The concentration of the gas exiting the storage tanks is monitored continuously with on-site analyzers and the flow to the biofilter is adjusted accordingly. Pressure in the storage tanks is regulated and the biofilter feed rate is controlled by an air-actuated gas flow valve coupled to an I/P actuator controller. The gas flow is monitored by a flow meter.

The control system, hardware, and software were purchased from National Instruments. This system is designed to be capable of monitoring and controlling the CHA paint vapor concentrator and Envirogen biofilter with only occasional human attention needed.

Gas/Liquid Solvent Volume in Storage Tank				Time to replenish tanks			
				Cycle from 150 to 100 psig			
Tank Pressure	150	psig		4	tanks		
Tank capacity	500	gal		50	psig	39.59	psig
Sovent Concentration	24000	ppm		500	gal		
Amount of Gas to Liquid	50%						
Tank volume	66.84	ft^3		267.34	ft^3		
Gas Volume in Tank	682.00	ft^3		909.33	ft^3	720	ft^3
Solvent Volume	16.37	ft^3		21.82	ft^3		
Total Solvent Mass	3.60	lb		4.80	lb		
Liquid Solvent Mass	1.80	lb		2.40	lb		
Liquid Volume	0.26	gal		0.35	gal		
Inlet Flow Rate	2	ft^3/min		2	ft^3/min	2	ft^3/min
Operation hours	24	hr/wk		24	hr/wk	24	hr/wk
Volume Gas introduced/week	2880	ft^3/wk		2880	ft^3/wk	2880	ft^3/wk
Time for Calculated Liquid Volume	5.68	hr		7.58	hr	6	hr
Liquid Solvent Volume/Week	1.10	gal/wk					
Number of Tanks	4.22	tanks					
Paint Operating Days per Week	4.50	hours/week					
Humidity	80%						
Temperature	70	F					
Chart	0.0125	lb H2O/lb DA					
Mass of Dry Air	64672.70	lb DA					
Mass of Water	808.41	lb H2O					
Percentage of water in knockout	67%						
Percentage of water in tank	33%						
Volume of Water knockout	64.56	gal/week	or	280.17	gal/month		
Volume of Water in Tank	31.99	gal/week	or	138.83	gal/month		

Figure 13. Tank storage worksheet.

B. BIOFILTER SYSTEM DESIGN AND CONSTRUCTION

Envirogen installed a predesigned, prefabricated P600 series biofilter at Tyndall AFB (Figures 14 and 15). The P600 series biofilter contains 600 cubic feet of filter media (proprietary compost blend mix) that treats 100 SCFM at a 6-minute contact time. The entire system is composed of a control panel, blower, humidification chamber, and biofilter vessel that sits atop a 40-ft x 8-ft x 4-ft trailer (Figure 16).

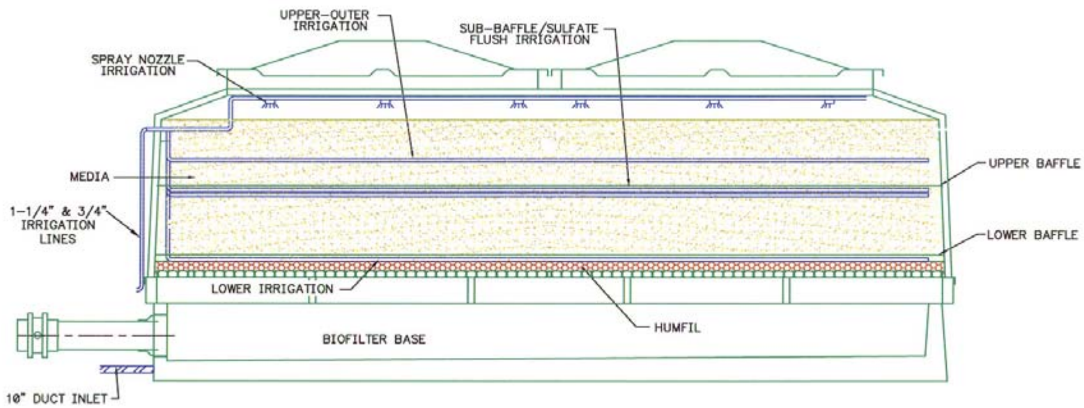


Figure 14. Schematic of the biofilter reactor.

Figure 15. P-600 biofilter setup.

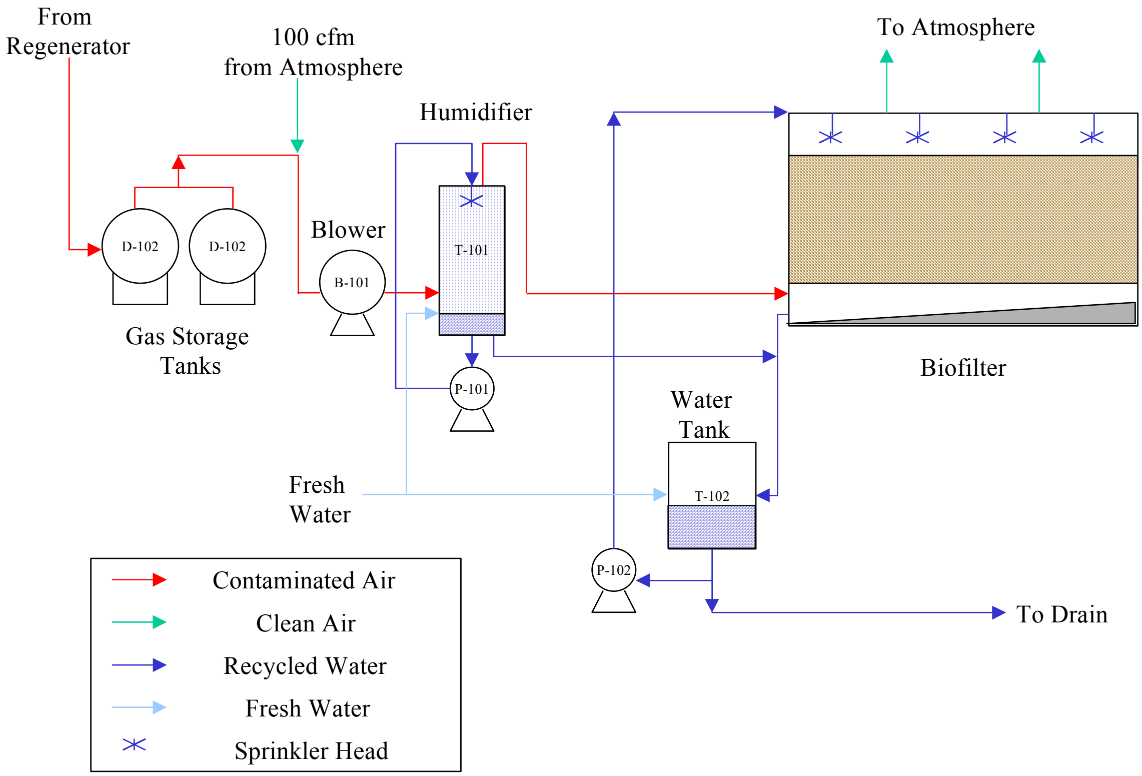


Figure 16. Schematic of biofilter setup.

The contaminated air from the concentrator unit enters a pipe before the blower and is mixed with approximately 100 CFM of ambient air. The air is passed through the bottom of a humidification chamber where the air is saturated with water. The saturated air enters the bottom of the biofilter reactor system through a plenum. The air passes upward through the media bed where it is treated and released to the atmosphere. Weep hoses are provided at various heights along the filter bed to provide substantial moisture control. Water is drained from the bottom of the reactor. A portion of this water is wasted to a drain while the rest is combined with fresh water and recycled back to the filter bed. This recycling of the wastewater provides nutrient return to the system and minimizes wastewater generation.

On-site air analysis of total organic concentrations was performed using one Eagle™ EM-700 (Irvine, California) and two Thermo Environmental Instruments Model 51 total hydrocarbon analyzers that sampled continuously. The analyzers measure air concentrations at the inlet of the adsorber, before the biofilter (after storage tanks), and after the biofilter reactor. The instruments used methane as a calibration gas standard. The data obtained from the analyzers were automatically logged into a data acquisition system. In addition, grab samples of air were also obtained on a periodic basis for off-site laboratory analysis to speciate the contaminants in the air.

III. TEST DESCRIPTION

A. TASK 1: ESTABLISH THE ABILITY OF THE DUAL TREATMENT SYSTEMS TO EFFICIENTLY PERFORM

The initial step of this project was to establish the ability of the concentrator–regenerator to work in conjunction with the biofilter treatment system. To maintain a thriving microbial population on the biofilter media, a constant source of organics (greater than 90 ppmv as methane carbon equivalents) must be supplied to the biofilter. The ability of the adsorber to effectively capture the paint booth emissions coupled with the capability of the microwave regenerator to free those contaminants from the carbon to feed to the biofilter required testing in the field. Prior to testing this concept in the field, we conducted numerous lab experiments at the bench-level to assess the concentrator–regenerator's abilities to handle paint emissions. In addition, the capabilities of the concentrator–regenerator were also tested for the treatment of solvents in water-saturated streams. Essentially, an air stream characteristic of the type that would be encountered in the field was passed through a bench-scale carbon bed system. The air moisture content was varied between dry and saturated. The carbon bed was varied between dry and saturated with water or saturated with solvent. Adsorption and regeneration tests were performed incorporating these varying conditions of the air and carbon bed to establish the effectiveness of the process. From these bench-scale studies, predictions of the concentrator–regenerator performance in the field were made.

Once the system setup was complete in the field, a side stream of contaminants from the paint booth was directed through a blower to the concentrator (carbon adsorber). After sufficient loading of the concentrator (based on theoretical calculations of mass loading from the paint booth), the carbon was regenerated and the emissions were fed to the storage tanks. The contents of the tanks were bled to the biofilter with dilution air. This study will demonstrate the ability of the storage tanks to provide a steady load to the biofilter and the ability of the biofilter to effectively treat the contaminants.

B. TASK 2: PERFORM A MASS BALANCE ACROSS BOTH SYSTEMS TO DETERMINE THE CAPTURE-AND-TREATMENT EFFICIENCY OF THE DUAL SYSTEMS

The ability of the concentrator–regenerator to effectively capture/release the contaminants to the biofilter for treatment was tested by artificially loading the system with known quantities of solvent. Performing mass balances for these exercises allowed for a complete inventory of all artificially introduced solvents, and capture efficiencies, regeneration efficiencies, and destruction efficiencies were thus calculated for the concentrator, regenerator, and biofilter, respectively.

The amount of carbon in the lower carbon adsorber hopper was calculated to be 426 lbs. Based on this value, 21.3 lbs (11.9 liters) of mixed solvents (57% MEK, 28% 2-Pentanone, 15% toluene by mass) were artificially loaded to the system (5 % loading on

carbon). With the blower from the paint booth turned on (pulling in ambient air only), a peristaltic pump was used to slowly inject 11.9 liters of the mixed solvent onto a wick located upstream of the blower and downstream of the carbon hopper unit. A wick was used so that complete evaporation into the blower discharge air would occur before entering the carbon adsorber. During the artificial loading, two Thermo Environmental Instruments Model 51 total hydrocarbon analyzers using flame ionization detectors (FIDs) sampled continuously. The detectors measured the inlet total hydrocarbon concentrations entering and exiting the carbon adsorber. The capture efficiency across the adsorber was calculated from these measurements.

From the adsorber, carbon was regenerated for 40 hours to ensure that all the solvent that may have loaded the carbon could be removed. It was estimated that 15 lbs/hr of carbon could be effectively regenerated; hence, the amount of carbon theoretically regenerated was 600 lbs. This was over 150 lbs more than the lower carbon hopper adsorber contained (total of 426 lbs.). The contaminant from the carbon was regenerated into the storage tanks over a 20-day period. The contaminant concentrations were measured exiting the storage tanks and entering the biofilter. From these concentrations and a known flowrate, the mass of contaminant in the tanks could be calculated.

From the storage tanks, contaminants entered the biofilter and were degraded. Destruction efficiencies were calculated across the biofilter by measuring inlet and outlet concentrations using the two hydrocarbon analyzers. A mass balance over time was then calculated from the concentration and flow going into and out of the biofilter. To ensure that the biofilter maintained a thriving microbial population while this extended study progressed, an artificial load of solvent (MEK) was added to the system periodically between feedings from the storage tanks.

A complete mass balance across all the systems was calculated. This procedure involved establishing a mass inventory for the introduced solvents for each step of the process. This included accounting for the mass of contaminant introduced and retained by the adorber, the mass lost across the adorber, the mass regenerated from the carbon, the mass remaining on the carbon, the mass lost in the transfer to the storage tanks and the biofilter, and the mass removed across the biofilter.

C. TASK 3: RECYCLE AIR THROUGH THE BIOFILTER TO IMPROVE UPON THE SYSTEM'S PERFORMANCE TO ELIMINATE AN ARTIFICIALLY GENERATED ORGANIC LOAD

Recycling the air in a biofilter can conceivably produce better degradation within the biofilter because of the longer gas residence time. However, to demonstrate this fact, we had to establish a critical mass loading into the biofilter. The point where the loading rate and the removal rate diverge is the critical mass loading rate. Essentially, it is the point where the removal across the filter decreases from 100 percent. Once the critical mass loading rate is known, the biofilter system can be operated at this loading. Since all

the contaminant is not treated, a certain portion of the effluent air can be recycled back to the inlet of the biofilter for further treatment.

To establish the critical mass loading rate, a solvent (MEK) was introduced artificially into the storage tanks in a liquid form along with some pure nitrogen gas. The addition of the nitrogen gas to the storage tanks agitated the air inside the tanks, causing the liquid solvent to vaporize. By adding more liquid solvent to the tanks with known nitrogen gas volumes, the concentration of solvent in the biofilter feed line could be increased. Increasing concentrations of solvent (thus increasing loads) were introduced to the biofilter reactor (at constant flowrate). Spot measurements, using two hydrocarbon analyzers, were taken along the length of the biofilter to establish the loading rate that would produce breakthrough at the top of the biofilter. The point where the loading rate and the removal rate diverged was the critical loading rate.

Once a critical loading rate was established, the reactor design was changed so that a portion of the effluent air from the biofilter could be recycled to the inlet of the biofilter for further treatment (Figures 17, 18, and 19).

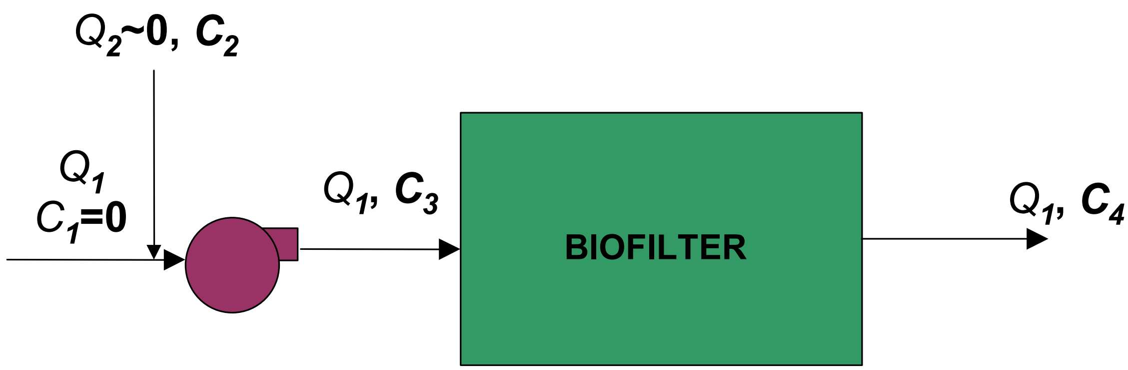


Figure 17. Normal biofilter system operation. Q_1 is the total flow into the biofilter; C_1 is the ambient air concentration; Q_2 is the flow from the storage tanks; C_2 is the storage tank concentration; C_3 is the concentration of air entering the biofilter (made up of C_1, C_2, Q_1, and Q_2); C_4 is the effluent concentration of the biofilter air.

The biofilter was operated under conditions that exceeded the critical loading to produce an effluent concentration 10% of the influent. The two hydrocarbon analyzers were placed at the inlet and effluent lines for solvent concentration measurements. A volumetric portion (recycling ratio = returned air flowrate/total flowrate) of the effluent was then recycled back to the biofilter, allowing calculation of a biofilter destruction efficiency. The experiment was repeated several times at differing volumetric recycling ratios to determine the effects that recycling would have on overall biofilter performance.

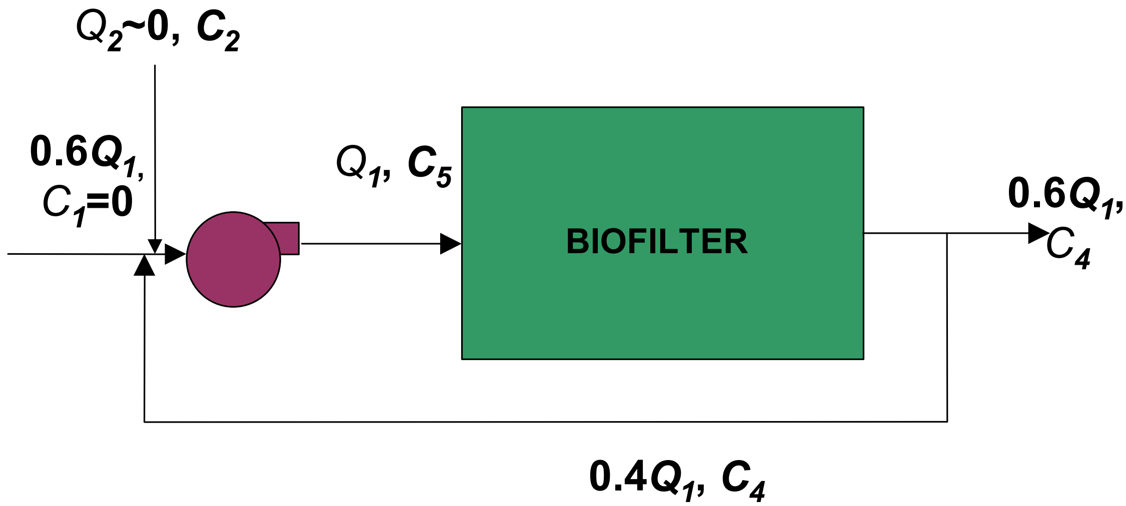


Figure 18. Recycle experiment setup. This case assumes a 40% recycle ratio. When in recycle mode, C_3 and C_4 combine to produce a new steady-state influent concentration (C_5) to the biofilter.

Figure 19. Reconfigured biofilter set for recycling of air operation. Notice recycle piping leading from one of the biofilter effluent stacks back to the suction side of the blower.

D. TASK 4: ESTABLISH THE COST-EFFECTIVENESS OF THE DUAL-PHASE TREATMENT SYSTEM

In this study, one paint booth was utilized to feed the concentrator–regenerator followed by the biofilter. This one booth provided a sidestream of air (2,000 scfm) to the concentrator (carbon adsorber). The total airflow available from the paint booth was actually 30,000 scfm. Assuming this type of flow is to be seen on a consistent basis, then scaling up of the carbon bed and regeneration systems would be required. Since the concentrator–regenerator provides organics to storage tanks that are bled off to the biofilter, the actual biofilter design specifications (in this case) remain the same. Hence, no further scaling is necessary. Capital costs are developed for both the concentrator–regenerator and biofilter. System mobilization, installation, and up-front training costs are included in the capital costs.

In addition to the capital costs, operating costs for the dual systems are provided. For the concentrator–regenerator system, the two major operating costs are the electricity demand and the amount of operator attention required. Costs associated with system maintenance, including various costs for replacement parts, are included. Biofilter operating costs include operator attention hours, electricity demand, and water consumption. Finally, a Net Present Value is calculated for the combined system.

IV. RESULTS

A. TASK 1: ESTABLISH THE ABILITY OF THE DUAL TREATMENT SYSTEMS TO EFFICIENTLY PERFORM

1. Concentrator–Regenerator Bench-Scale Studies

While construction of the concentrator–regenerator system was occurring, two bench-scale studies were performed to replicate possible operating conditions that may be generated by the paint booth and introduced to the concentrator–regenerator. One study focused on determining the ability of the system to effectively adsorb and regenerate typical paint booth solvent emissions. The second study was conducted to determine the effect of adsorbed water on GAC adsorption capacity.

Bench-Scale Study One

In the first experiment, a solvent consisting of 57% MEK, 28% 2-pentanone, and 15% toluene was mixed for application to carbon. Three hundred and sixty pounds of 80 CTC pelletized activated carbon was utilized in a moving-bed adsorber to adsorb 3062 g of the solvent mixture, this corresponded to a 1.87% solvent loading and assumed uniform adsorption. This level of saturation was representative of field test conditions. The inlet solvent stream was temperature controlled to 80^{o}F at a gas flow rate of 100 CFM. The carbon flow rate through the moving bed adsorber was 15 lb/hr.

The next phase of this experiment was to regenerate this solvent-loaded carbon. The carbon was divided into six equal portions of approximately 60 pounds. One portion of the saturated carbon was regenerated in a ½-scale microwave regenerator with central gas porting. Two microwave inputs rather than the full-scale four microwave inputs were used for this study. Two kW of applied microwave energy and a carbon flow rate of 10 lb/hr were tested. A weight loss of 1.6% was seen during this initial test.

The next test run utilized the 4-kW, helix-coupled microwave regenerator at a carbon throughput rate of 24 pounds of carbon per hour. The rotational rate of a star valve located at the base of the reactor determined the carbon regeneration rate for these tests. A nitrogen sweep gas was applied to the carbon at a rate of 70 standard cubic feet per hour (SCFH). All four 1-kW microwave magnetrons were operational during the course of this initial experiment. A weight loss of 1.6% was observed during this test. The outlet gas temperature and regenerated carbon temperature as a function of regeneration time are shown in Figure 20. At these operating conditions, the outlet gas temperature settled at a temperature of 425^{o}F and the carbon temperature at 650^{o}F. The total liquid solvent collected during this test weighed 95 grams.

Figure 20 shows that the carbon and gas temperatures reach their steady-state values in one hour. This trend was noted throughout all of the preliminary tests completed with this reactor configuration.

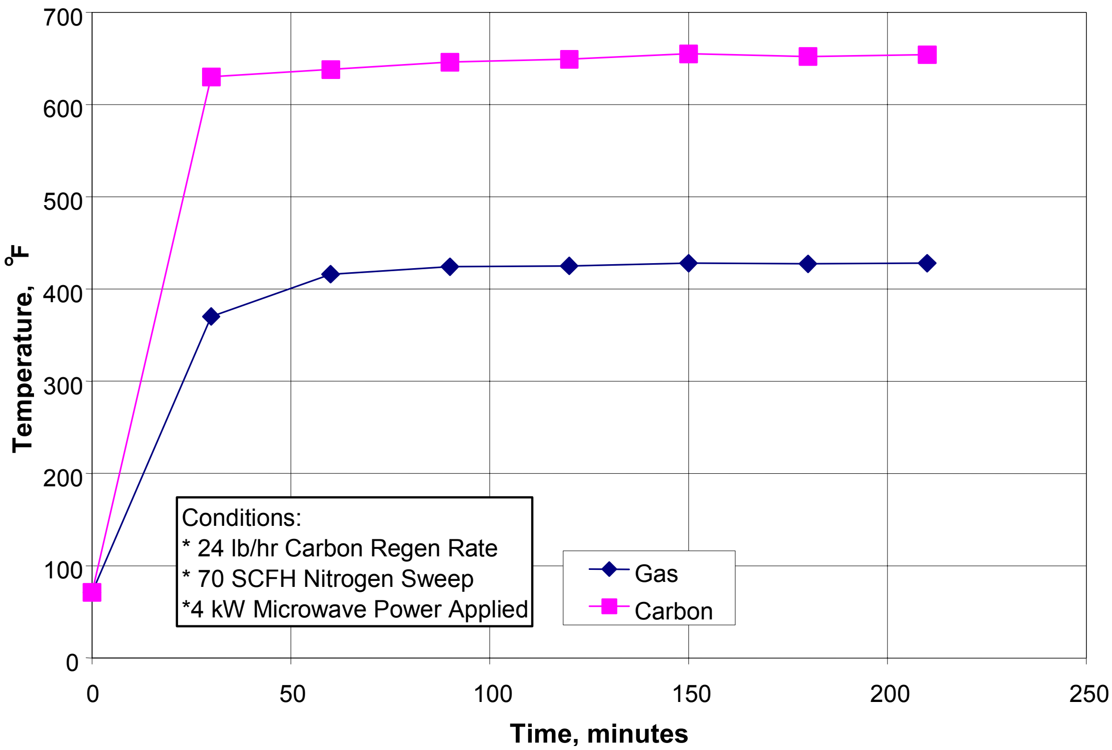


Figure 20. Outlet gas and carbon temperature as a function of regeneration time (first test).

A second cycle was completed in each of the shakedown tests. This was done to determine what additional weight loss could be achieved with other carbon regeneration conditions. The second cycle of the previously mentioned carbon sample used the same operating conditions as the first cycle. The gas and carbon temperatures leveled out at 435°F and 670°F respectively. An additional weight loss in the carbon of 0.8% was measured during the second cycle. No liquid solvent was recovered during the second cycle. The gas and carbon temperature trend seen in Figure 20 was also observed during this test. These were the conditions used to regenerate the activated carbon from the radial adsorber in future tests.

Bench-Scale Study Two

Four-millimeter pelletized activated carbon was used to perform tests to determine the interaction of adsorbed water and solvent adsorption that may occur in a humid environment.

This series of tests was performed to observe the effects of GAC water pre-saturation, air saturated with water carrying heavy solvent (butyl acetate), and dry air water desorption phenomenon. In the first test, a 4-inch bed of 4-mm pelletized GAC (140g) was placed in a 2.36-inch diameter quartz tube reactor. Fifty standard cubic feet per hour (SCFH) of dry air was passed through a water sparger to promote saturation. The water-saturated air was then passed through the carbon bed and bed weight

measurements were made periodically until no weight gains were noted. The GAC adsorption of water was 60.4g water/100g GAC. Once the GAC was completely saturated 50 SCFH dry air was passed through the bed. Similarly, weight measurements were recorded until no weight change was noted. By passing dry air through the water-saturated GAC bed, all of the water desorbed in a relatively short time period. The final weight of the GAC after desorption was equal to the initial weight of the dry GAC (140g). These water adsorption and desorption data may be seen in Figure 21.

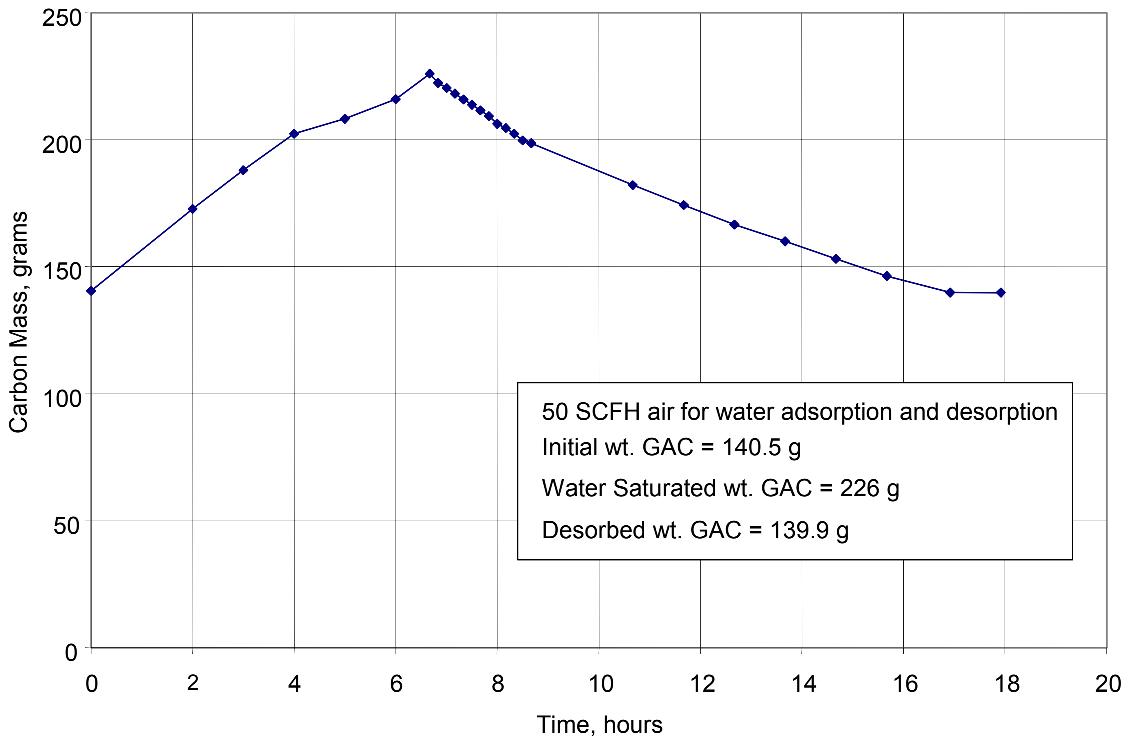


Figure 21. Water saturation and desorption of GAC.

Concurrently with this experiment, a desorption experiment with solvent was completed. In this test, another GAC sample was saturated with water in the same manner as the previous experiment. The GAC adsorption capacity for water in this case was 45.4g water/100g GAC. The next step involved passing dry air carrying 200 ppm of solvent through the bed and monitoring the outlet total hydrocarbon (THC) concentration. Periodically, the gas flows were stopped and weight measurements were taken. The water-saturated GAC lost weight due to water desorption, as in the "straight" desorption experiment. During the weight loss time of the experiment, no hydrocarbon was detected at the outlet vent, therefore demonstrating that the solvent was completely adsorbed even though the GAC was water-saturated. After some time the weight of the carbon sample began to increase due to solvent adsorption. The carbon weight was measured regularly and the THC concentration was recorded until 5% breakthrough was achieved. The adsorption capacity for the solvent was measured at 19.8 g solvent/100 g GAC.

Overall, 27.1 g of solvent was injected in this experiment. The final weight of the GAC was measured at 163.5 g while the initial weight was 137 g resulting in a weight gain of 26.5 grams. This value closely corresponds to the injected solvent mass (27.1g). The data show that water pre-saturation has no significant effect on GAC adsorption capacity with dry air streams carrying solvent. Therefore activated carbon will remain an effective adsorbent in a humid environment. Figure 22 shows the desorption and subsequent solvent adsorption data for both of the previously mentioned experiments.

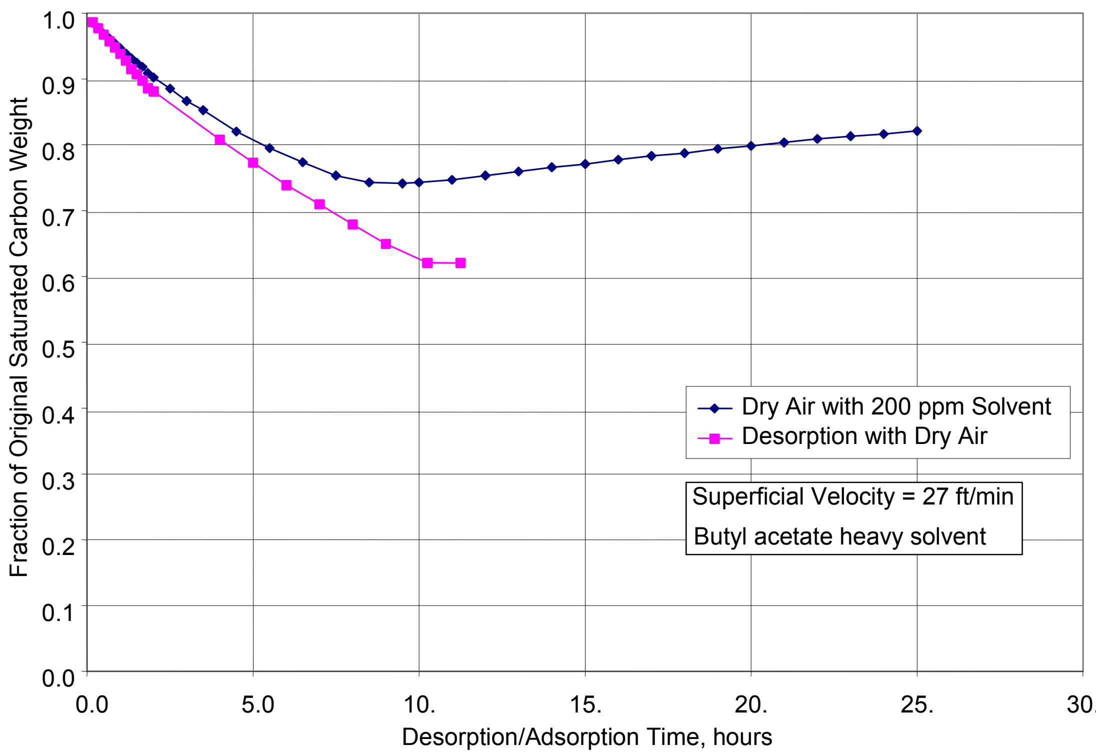


Figure 22. Comparison of dry air desorption with dry air carrying 200 ppm solvent on water-saturated GAC.

In the third procedure, carbon was once again completely saturated with water as in the previous experiments. The GAC adsorption capacity for the water in this case was 53.6g water/100g GAC. In this test, 50 SCFH of air, saturated with water and carrying 1000 ppm of solvent, was then introduced to the water-saturated GAC. The weight of the water-saturated carbon did increase throughout this experiment. One portion of the weight increase was due to the water in the air (72.5%) while another portion was due to solvent adsorption (27.5%). This experiment was continued until 50% breakthrough of the solvent was achieved. The adsorption capacity for the solvent was determined to be 9.35 g solvent/100 g GAC for this experiment. This level of adsorption is approximately 50% less than that measured with dry air carrying solvent. In a final comparative test, dry carbon was contacted with 50 SCFH of water-saturated air containing 1000 ppm solvent. This 1400g GAC sample adsorbed 37.5 g of solvent for an adsorption capacity of 24.6 g solvent /100 g GAC. This adsorption capacity is similar to that achieved with water saturated carbon and dry air.

The results of the four tests indicate that the adsorption performance of the GAC will be sustained so long as the regeneration stage of the process removes most of the adsorbed water. In the past, the CHA regenerator has been very effective for the removal of adsorbed water. With essentially dry carbon, the solvent adsorption capacity will not be seriously affected. The only set of conditions that resulted in decreased adsorption capacity occurred when both the GAC and incoming air/solvent stream were water saturated. This set of conditions was not expected during the test period with efficient on-site GAC regeneration. The four tests provided a relatively accurate model for the adsorption conditions that were experienced during the on-site test period.

2. Field Operation of the Concentrator–Regenerator with the Biofilter

Operation of the concentrator–regenerator in conjunction with the biofilter offered numerous operational and engineering challenges. First, we established what concentration (load) of solvent would be available to the biofilter on a continuous basis (Figure 23). This design worksheet used actual ventilation gas data (from July 1999 painting records) from the paint booth site to determine the frequency and amount of painting that occurred. Air samples for TO-14 speciated contaminant analysis were taken from the paint booth during its operation. Results demonstrated that the primary contaminants from the booth were methyl ethyl ketone (MEK), 2-pentanone, and toluene in concentrations of 25, 13, and 7 mg m^{-3}, respectively (Appendix A). In the worksheet, the solvent concentration of the 100 CFM feed stream was calculated on a methane basis. The worksheet established that a concentration of approximately 90 ppmv would be continuously available to the biofilter for the duration of the project. This concentration value and duration were predicted from the supply of actual paint solvent in the paint booth vent gas analytical data taken in July 1999. Figure 23 also provides the saturation and regeneration time of the carbon from the lower section of the radial adsorber.

Unfortunately, the quantities of paint used in July 1999 did not correspond well with the amount of paint used during the initial stages of this demonstration. Changes in the painting procedure, the use of new overspray capture guns, and the lower demand for equipment requiring painting in the particular booth that was feeding the adsorber were all reasons that contributed to the lower-than-expected loading of the adsorber hopper. In addition, for the calculations made in Figure 23, certain assumptions had to be made about the quantity of solvent emission from the paint application and the capture of this solvent by the blower. These estimated assumptions appear to be greater than the actual numbers. Based on the design worksheet, 21 days would be required to provide enough paint to the storage tanks to provide six days of feed to the biofilter. If lower feed concentrations could be used, the amount of feed time to the biofilter could be doubled.

Numerous problems arose with the concentrator–regenerator system that did not allow for sufficient quantities of contaminant to be provided to the storage tanks on a timely basis. A table of these problems, the necessary time for the operator to correct the problems, and the overall downtime caused by these problems over the course of Task 1 appears in Appendix B, together with the daily data sheets for the biofilter operation.

ENVIROGEN Solvent Feed Availability Spreadsheet

Solvent	Formula	M.W.	%
MEK	C_4H_8O	72.1	57%
2-Pentanone	$C_5H_{10}O$	86.1	28%
Toluene	C_7H_8	92.1	15%

Total M.W.	79.02
CH_4 Equivalent	4.73
Capture Efficiency	95%
Regeneration Efficiency	60%

Quantity of Paint used during 61-day Test	141.75	qt
Painting time during 61-day Test	39.25	hrs
Total Paint used per hour of Painting Test Operation	0.903	qt/hr
Paint Solvent Concentration from Sample Canister	41	ppm
Quantity of Solvent using the Canister Solvent Concentration	0.938	qt/hr
Calculation for Paint Solvent used over 61-day Data Sheet	0.025	qt/hr
Volumetric Flowrate of Solvent	0.198	cu ft/hr
Bug Feed Concentration Available for 100-CFM Stream	32.976	ppm
CH_4 Equivalent Bug Feed	155.979	ppm
CH_4 Equivalent Concentration with Performance Efficiencies	88.908	ppm
Carbon in Initial Section of Adsorber	426	lb
Percent Solvent Load	5.0	%
Amount of Solvent Adsorbed	21.3	lb solvent
Solvent Adsorbed from Painting Operation	0.0416	lb/hr
Load Time (hours)	512.5	hr
Load Time (days)	21.4	days
System Online Regeneration Time	24	hrs/week
System Operation	5	days/week
Regeneration Rate	15	lb/hr
Carbon Regenerated	72	lb/day or 3 lb/hr
Regeneration Time (hours)	142.0	hrs
Regeneration Time (days)	5.9	days

Figure 23. Solvent feed concentration availability worksheet.

The majority of the problems with the concentrator–regenerator system were typical of a prototype design. In particular, most of the system downtime was a result of poorly operating electrical equipment like magnetrons, transformers, flow gauges, and

valves. For this new application, different types of electrical equipment were used that oftentimes could not handle the workload; hence, this equipment was not robust enough and was replaced. The software program written to operate the concentrator–regenerator often required updating as unforeseen failures would occur within the system that the program could not resolve. Such software glitches were eliminated as new problems with the system were identified and repaired. A large portion of time during Task 1 was spent by both Envirogen, Inc., and CHA personnel repairing or correcting operational problems with the concentrator–regenerator system, analytical equipment, and various air distribution problems from the storage tanks to the biofilter. Such numerous upsets, coupled with the low organic loading, produced nonsteady-state conditions from the storage tanks to the biofilter (Figure 24). Figure 24 demonstrates over a short period of time the fluctuations in loading seen during a portion of Task 1. Even with this fluctuation in loading, removal percentages across the biofilter were still 80%.

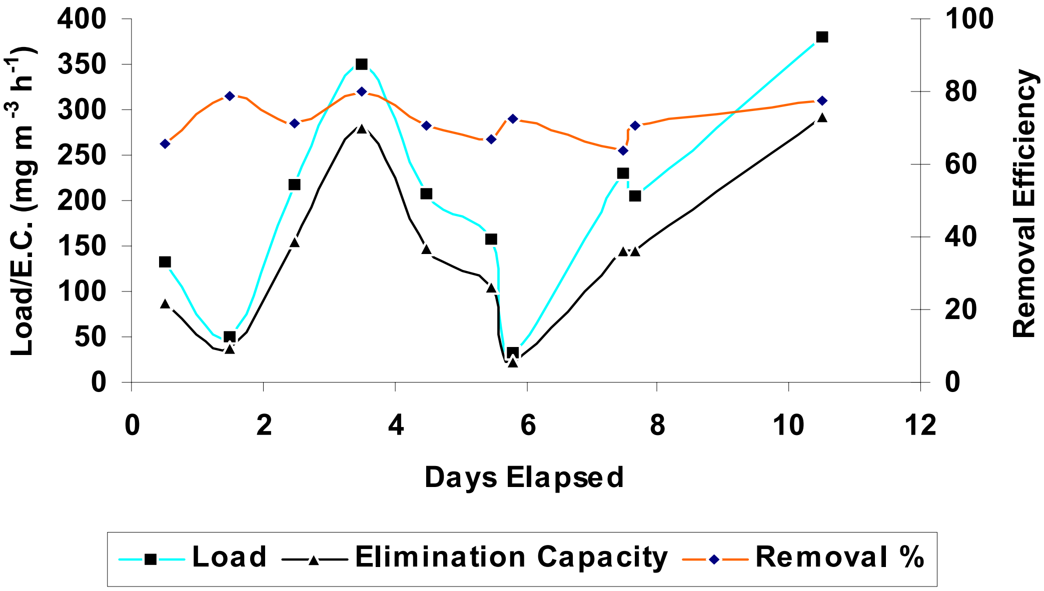


Figure 24. Load, elimination capacity, and removal efficiency across the biofilter reactor over a two-week period during Task 1.

Since the paint booth loading was inadequate and system problems continued to delay the artificial load experiment to the concentrator–regeneration unit (for Task 2), an artificial solvent load was supplied directly to the biofilter to maintain the microbial population. This artificial load consisted of a majority of MEK, with smaller percentages of 2-pentanone and toluene. Air samples were analyzed along the length of the biofilter and are presented in Figure 25. Based on the low flow and long gas residence time, the majority of contaminant removal (87%) occurred in the first 0.5 feet of bed depth. This percent removal equated to an elimination capacity of approximately 6 g m^{-3} hr^{-1} across the first 0.5 feet of bed. Such removal demonstrates that the microbial population was kept active until Task 2 was started.

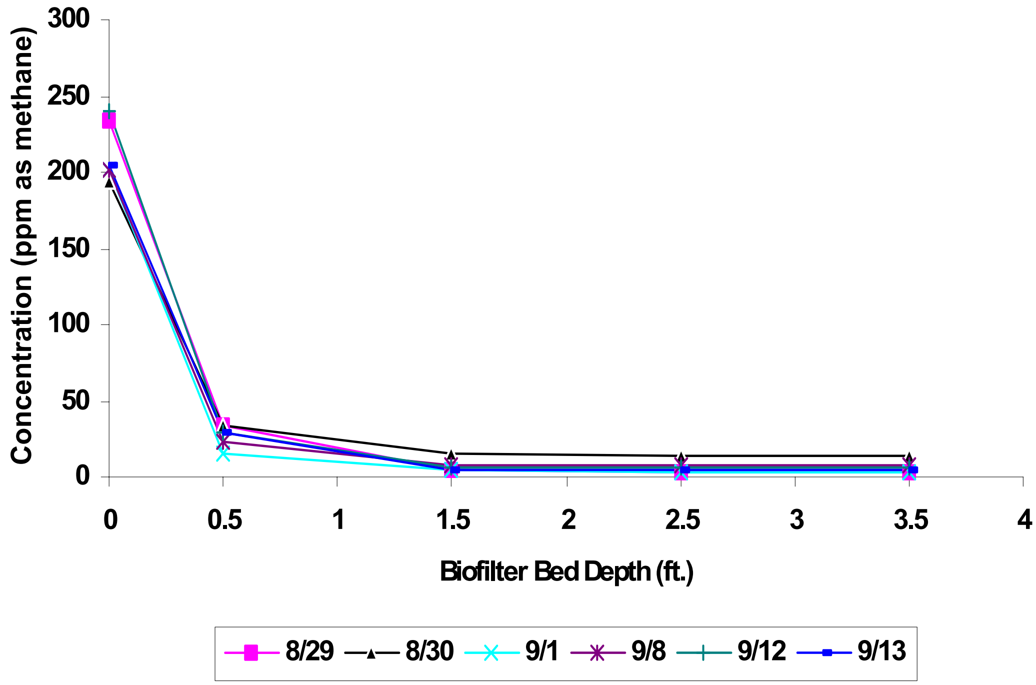


Figure 25. Concentration of contaminant versus biofilter bed depth.

B. TASK 2: PERFORM A MASS BALANCE ACROSS BOTH SYSTEMS TO DETERMINE THE CAPTURE AND TREATMENT EFFICIENCY OF THE DUAL SYSTEMS

After discovering the lower-than-expected loads from the paint booth and resolving the numerous setbacks with the operation of the dual treatment system, an artificial solvent load was introduced through the main ducting to the adsorber to demonstrate the effectiveness of the concentrator–regenerator with the biofilter system. The goal was to obtain a complete mass balance across all the systems of the treatment train.

The amount of contaminant loaded onto the carbon adsorber was theoretically calculated and experimentally measured. For all mass measurements provided, the mass is given in terms of carbon (unless noted). Based on the known volumes and densities of the solvents, a theoretical total mass of 6575 g as carbon was loaded onto the carbon adsorber. Using the continuous data from the inlet and outlet hydrocarbon analyzers and knowing the flowrate of the air, a load-versus-time curve was established for each injection of solvent. Three injections in all were conducted with injection 1 occurring on one day and injections 2 and 3 occurring on the following day (Figures 26 and 27).

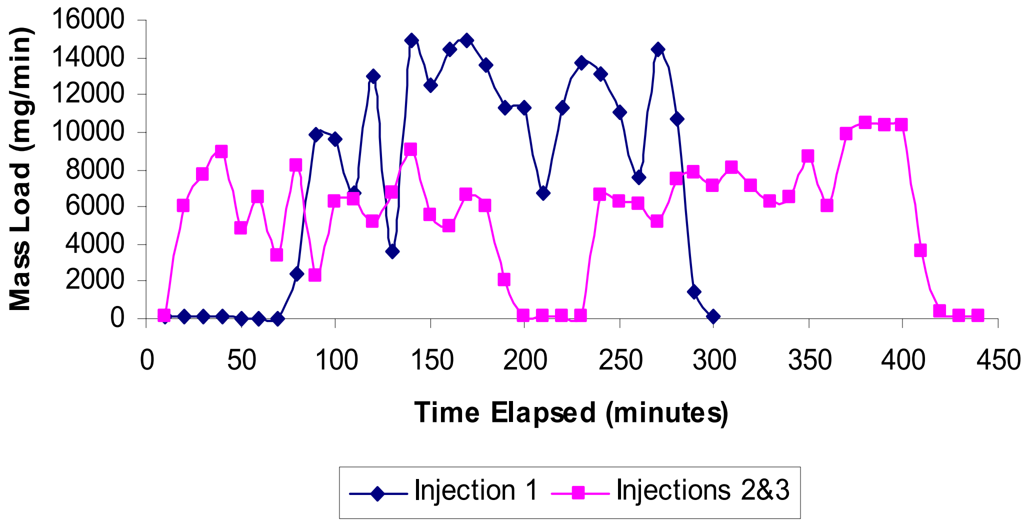


Figure 26. Mass load versus time for inlet to adsorber.

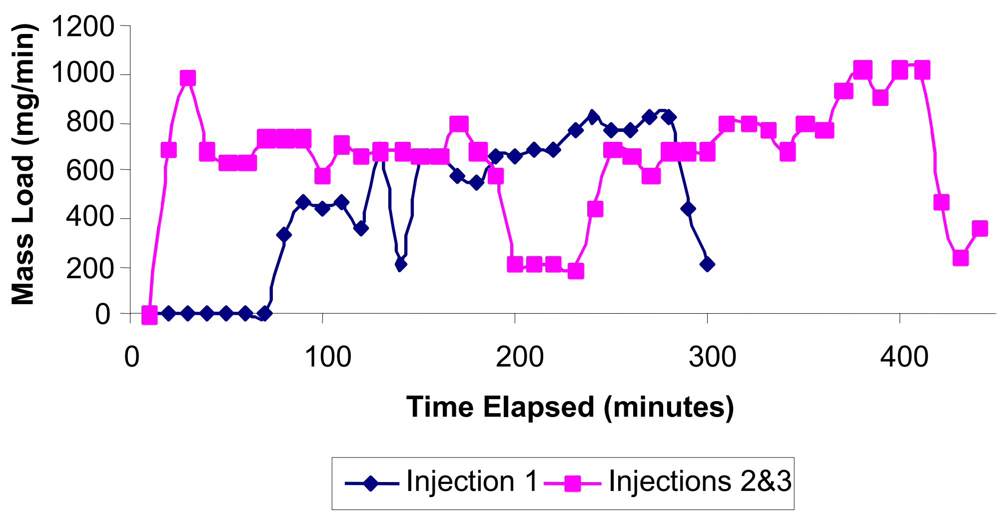


Figure 27. Mass load versus time for outlet from adsorber.

Performing a Reimann–Sums approximation for the area under these curves provided a total mass entering and leaving the system. These data and the calculation appear in Appendix C. Based on this procedure, the experimentally determined mass entering and leaving the adsorber was 4674 g and 396 g of carbon, respectively. This provides a total efficiency of 92% across the carbon adsorber. The manufacturers of the adsorber discovered that a portion of the air was slipping past the carbon containment walls, accounting for the 8% loss. The difference between the theoretical and experimentally determined amounts of contaminant provided to the carbon adsorber differ by 1901 g (6575 g minus 4674 g). Some possible reasons for this large difference

may be attributable to poor transfer of the solvent from the peristaltic pump to the air stream and adsorption of the contaminant to the pipe ducting leading to the carbon adsorber. Efforts were made to collect data for an extended period after all the solvent had been added to the air stream, but only traces of residual contaminant could be seen by the analyzers within an hour after the last volume of solvent had been added. For this phase of the mass balance study, 1901 g were lost in the ducting to the adsorber while 396 g were lost across the adsorber, for a total efficiency of 65%. Overall, 4278 g were loaded onto the carbon and this number was used in calculating the efficiency of the regenerator (Table 1).

Mass Balance Across the Concentrator	
Theoretical Mass In (calculated) (g)	6575 g
Experimental Mass In (g)	4674 g
Experimental Mass Out (g)	396 g
Experimental Percent Capture (%)	92 %
Theoretical and Experimental Mass Loading Difference (g)	1901 g
Overall Theoretical Percent Capture (%)	65 %
Actual Mass Remaining on the Carbon (g)	4278 g
Mass Balance Across the Regenerator	
Mass Regenerated Off the Carbon Into the Storage Tanks (g)	647 g
Percent Regenerated From Carbon of 4278 g (g)	15 %
Mass Not Regenerated or Lost from the Carbon to Biofilter (g)	3631 g
Mass Likely Regenerated (Laboratory Determined, 91%) (g)	3893 g
Mass Unaccounted for Not Reaching the Biofilter (g)	3246 g
Mass Lost to Water Knockout Tank (g)	51 g
Mass Lost to Vacuum Pump (g)	22 g
Mass Likely Lost to Storage Tanks and Piping (g)	3173 g
Mass Balance Across the Biofilter	
Mass Released from Storage Tanks to Biofilter (g)	647 g
Mass Degraded Across the Biofilter (g)	97 g
Percent Destruction (%)	85 %

Table 1. Mass balance experimental and derived data.

The loaded carbon was regenerated for a total of 40 hours to ensure that all the carbon that had been subjected to the artificial load was thoroughly treated. The regeneration period of 40 hours did not occur consecutively, but was generally broken up into 4-to-6-hour sessions performed on different days. After each regeneration session, the contaminated air that was in the storage tanks was released to the biofilter. Total hydrocarbon analyzers monitored the inlet and outlet concentrations across the biofilter. By knowing the airflow through the biofilter, the concentration of hydrocarbons entering into the biofilter, and the airflow from the storage tanks to the inlet side of the biofilter, a hydrocarbon concentration coming off the storage tanks was calculated (Appendix C). With this calculated concentration and knowing the air flowrate and the time interval of measurements, a mass of total solvent (as carbon) stored in the tanks could be calculated

for each regeneration session. Based on this approach, the total amount fed to the biofilter from the storage tanks was 647 g. Of this 647 g, 85% removal across the biofilter occurred (Appendix C). Even though the biofilter had a long residence time, it was not subjected to toluene and 2-pentanone vapors on a consistent basis (unlike MEK). Hence, it is likely that the 15% of untreated air in the biofilter consisted mostly of these contaminants (Figure 28). As shown in the graph, regenerated VOC was degraded mainly in the lower first foot of bed material, with little degradation occurring throughout the rest of the bed. Additionally, the initial concentrations of total solvents were higher for the earlier days of analysis as the microbes became acclimated to the contaminants. However, it appears that there was not a long enough acclimation period for the microbes to effectively degrade a portion of the air stream contaminants (likely toluene and/or 2-pentanone). Similarity exists between Figures 25 and 28. However, in Figure 28 it can be seen that MEK was being degraded, while other contaminants were not.

The 647 g experimentally determined in the field to be regenerated accounted for 15% of the contaminant that was experimentally loaded onto the carbon (4278 g). The mass loss from the carbon, through the regeneration process, and to the biofilter was 3631 g. An investigation as to where these losses occurred was undertaken.

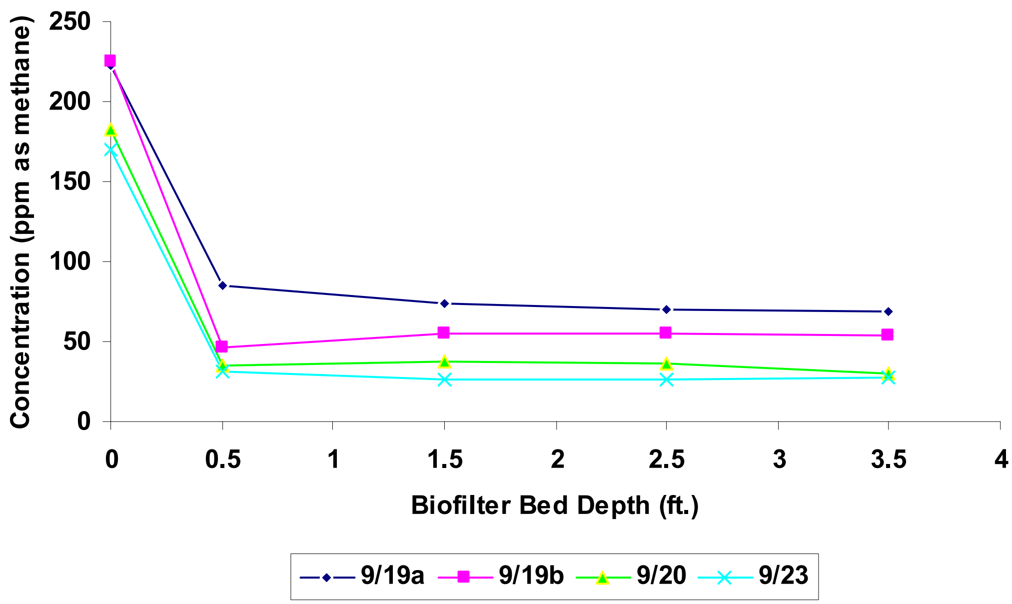


Figure 28. Concentration versus biofilter bed depth for regenerated gas feed (portions).

It was possible that a majority of the contaminant on the carbon was effectively regenerated, but lost between the regeneration process and the biofilter system. To determine the efficiency of the regeneration process itself, two samples of loaded carbon were acquired before and after the regeneration process and sent offsite for solvent analysis at Envirogen's certified lab. The laboratory data are provided in Appendix D. Based on the laboratory results, the average mass of solvent (as carbon) per mass of adsorbed carbon was 1704 mg/kg. Extrapolating this to the entire 600 lbs (273 kg) of

carbon regenerated, the total mass of contaminant on the carbon was 465 g (as carbon). This value was far short of the experimentally measured value, 4278 g, on the carbon before regeneration (9.2 times less). The samples obtained for this analysis were taken from the final fifth of carbon to be regenerated. Hence, they likely did not represent the overall load seen for the entire 600 lbs of carbon. For the sample obtained after regeneration, the average mass of solvent (as carbon) per mass of adsorbed carbon was 149 mg/kg (91% regeneration efficiency). For 600 lbs (273 kg) of carbon, this amounted to 41 g of total solvent that was not removed by the regeneration process. However, it can be assumed that if more representative carbon samples were taken (in the first fifth of carbon) and the same regeneration efficiency was obtained, the total amount of solvent not regenerated would be **385 g** as carbon (9% of 4278 g). This value is considered an upper boundary. Based on the above data, it is likely that the regeneration process actually removed 3893 g of the original 4278 g on the carbon (91% efficiency). Of this 3893 g, the hydrocarbon analyzer measured value of 647 g eventually made it to the biofilter, leaving 3246 g unaccounted for in the mass balance.

After regeneration of the carbon, the solvent-laden air passed through a water knockout tank and a vacuum pump. Both pieces of equipment were potential sinks for adsorbed solvents. A sample of water that condensed in the knockout tank during the regeneration of the carbon was brought to the Air Force Research Laboratory (Tyndall Air Force Base, Panama City, Florida) for analysis. Analysis determined that during the 40 hours of regeneration of the carbon, 15.1 liters of water were generated in the water knockout tank. Laboratory analysis demonstrated an average total solvent concentration of 3352 mg of carbon/L. This provides **51 g** of carbon lost to the water knockout tank. For the vacuum pump, a sample of pump oil was heated on a hotplate and the weight change was measured. By extrapolating out the mass lost for the amount of oil used during the experiment, it was determined that **22 g** of carbon had potentially adsorbed into the oil. Future considerations for such a design should entail removing the knockout tank [or recovering solvents from the condensate] and using an oil-free vacuum pump.

The determination of possible losses from the regeneration process itself (385 g), the water knockout tank (51 g), and the vacuum pump (22 g), provides a total loss of only 458 g. This accounts for 12.6% of the 3631 g still missing in the mass balance. Several other factors were discovered after the mass balance experiment was conducted that could provide insight as to where much of this "missing solvent mass" was lost. We discovered various quantities of water in the storage tanks, absorbing solvents. These quantities were not analyzed, but certainly contributed to the lost solvent mass. In addition, we discovered that the distribution piping from the storage tanks to the biofilter had deteriorated considerably. Presumably, the MEK solvent vapors had adsorbed onto the PVC plastic piping and degraded its structural integrity. A hole in one section of the pipe was observed, indicating large amounts of MEK and other solvents had dissolved and degraded the piping. One final issue that may have contributed to the missing solvent was flowmeter accuracy in measuring flow from the storage tanks to the biofilter. Numerous difficulties were seen in obtaining a precise flow measurement in this line (possibly a result of the deteriorated piping). Hence, the calculations to determine the concentrations coming off the storage tanks by using the biofilter influent hydrocarbon

data may be skewed. If a lower flowrate were used in the calculation, the mass exiting the storage tanks might be larger, accounting for more of the "missing solvent mass."

C. TASK 3: RECYCLE AIR THROUGH THE BIOFILTER TO IMPROVE UPON THE SYSTEM'S PERFORMANCE TO ELIMINATE AN ARTIFICIALLY GENERATED ORGANIC LOAD

To demonstrate the concept of recycling the air to the biofilter, it was first necessary to overload the biofilter reactor. The inlet loading rate was increased (via increases in concentration) gradually until a breakthrough of contaminant at the effluent stack was seen. In Figure 29, it is seen that as the contaminant concentration increased, greater bed depth was needed to completely remove the total solvent load. Eventually, it was determined that, at a concentration of 2000 ppmv (984 mg m^{-3}) of MEK as methane equivalents, at least a 10% breakthrough was seen at the effluent (not shown in Figure 29). At a concentration of 2000 ppmv, this corresponds to a loading rate of 9.8 g m^{-3} hr^{-1} across the entire filter bed (considered the critical load). Other researchers have reported a critical loading capacity for MEK at rates of five times of those demonstrated in this biofilter (Devinny *et al*., 1999). However, the loading demonstrated for this system occurred in a nonsteady-state fashion, thus not allowing for constant microbial acclimation. Additionally, though the concentration was similar (0.76 mg m^{-3}) in earlier research with MEK, the gas residence time was much lower, providing for a different kinetic situation. Overloading of the biofilter in this study occurred over a short period of time. Eventually, microbial acclimation to higher loads may have occurred and performance would have increased. Time constraints did not allow for the prolonged operation at these higher loads. Hence, this value of 9.8 g m^{-3} hr^{-1} was used because it provided enough loading to see the necessary breakthrough for the recycling experiment (even if only temporarily).

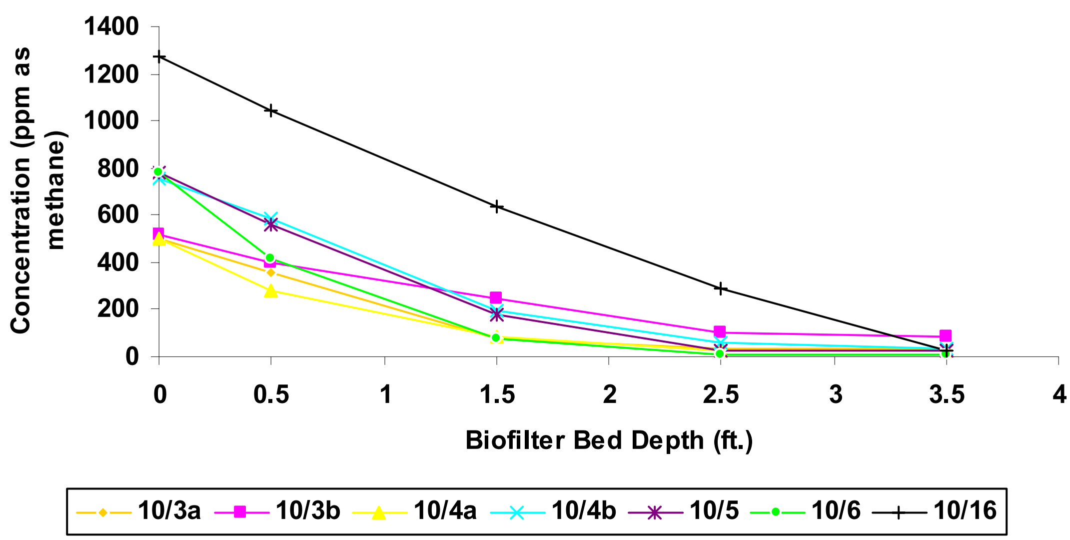


Figure 29. Concentration versus biofilter bed depth for increasing artificially generated solvent concentrations.

As a baseline for the recycling experiment study, the reactor was fed at the critical load with no recycling of air (Figure 30). Without recycling of the air, 82% of the MEK loading was degraded. After establishing this baseline, we conducted numerous experiments at different recycle ratios: 44%, 61%, 73%, and 78%, which provided removal efficiencies of 88%, 94%, 95%, and 98%, respectively (Figures 31–34).

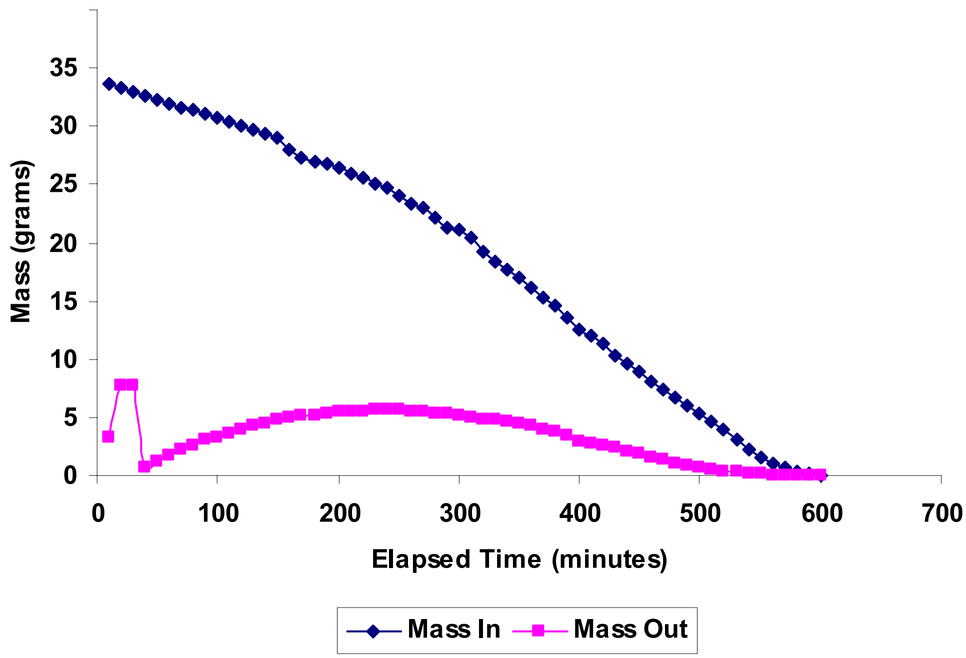


Figure 30. Mass in and out of the biofilter under no recycling conditions (82% removal).

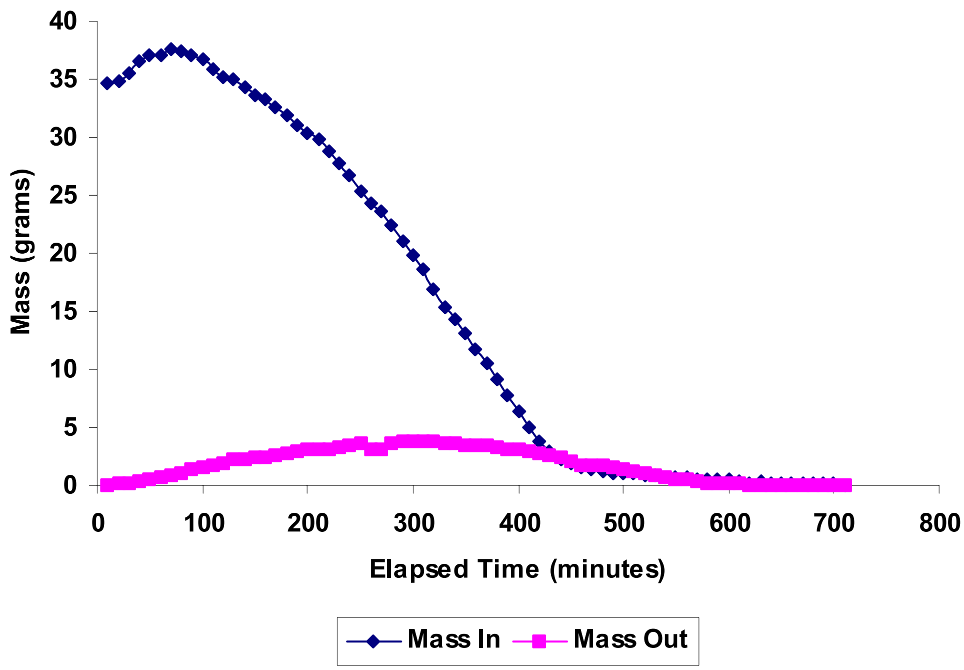


Figure 31. Mass in and out of the biofilter with a 44% recycle ratio (88% removal).

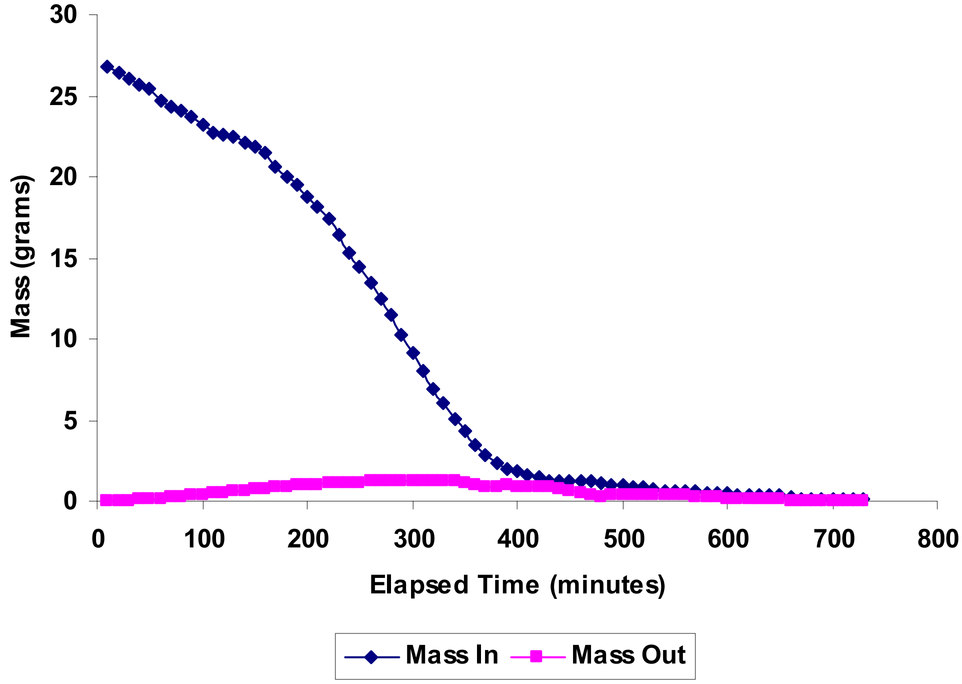


Figure 32. Mass in and out of the biofilter with a 61% recycle ratio (94% removal).

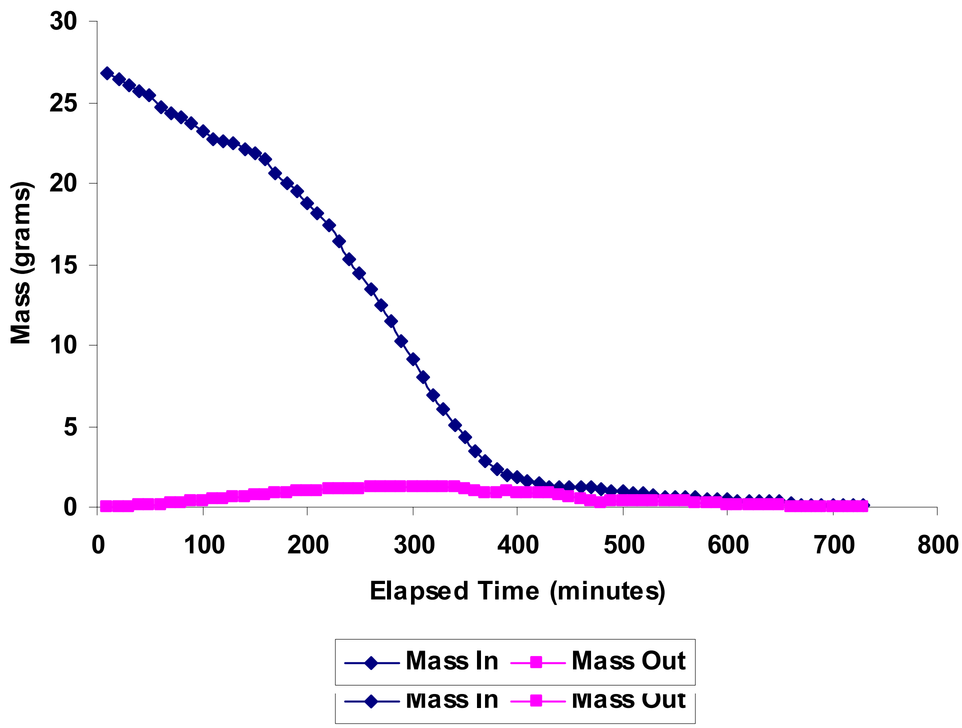


Figure 33. Mass in and out of the biofilter with a 73% recycle ratio (95% removal).

As was expected, there was a direct correlation between increasing recycle ratio and removal efficiency. For the critical load used in these experiments, it appears that oxygen limitations were not a factor. However, it was of interest to determine if daughter

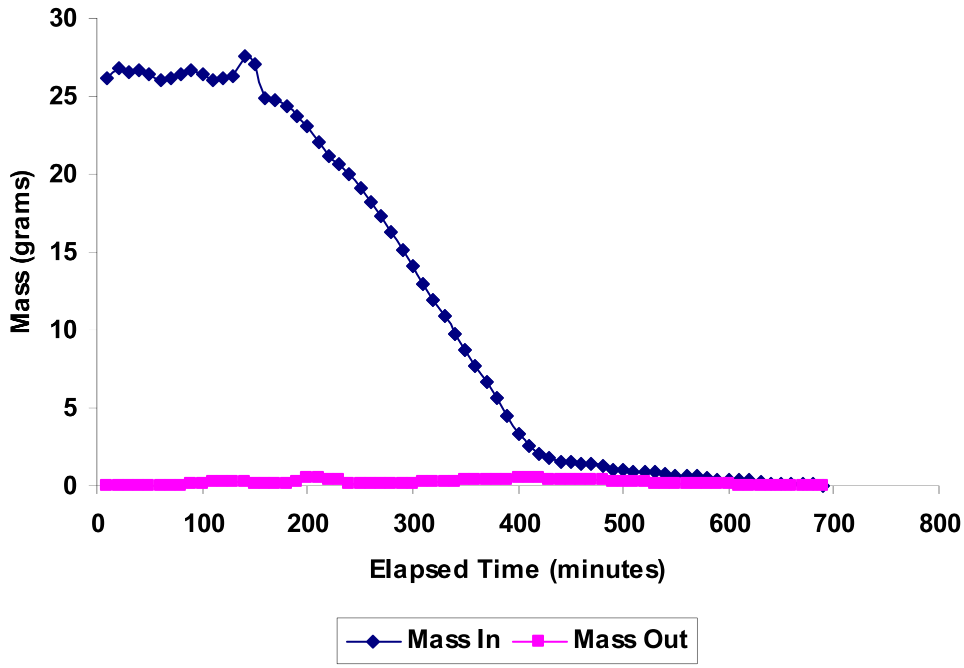


Figure 34. Mass in and out of the biofilter with a 78% recycle ratio (98% removal).

products were being formed that were not being treated by the process. From the result of Figure 34 (98% removal), this did not appear to be the case. Still, biofilter effluent air samples were collected in sampling bags and brought to the Air Force Research Laboratory for gas-chromatographic analysis. Results of the analyses appear in Appendix E. The analysis was strictly qualitative, but found traces of MEK, ethylbenzene, xylene, and phenol in the effluent (recycle gas stream). Near the location of the biofilter reactor was a jet engine test facility that often expelled various exhaust fumes. These fumes were released to the ambient air, which the biofilter pulled in as a dilution mechanism. The aromatics seen in the sample were likely a result of stray compounds from the jet test center. From the analysis provided, there appear to be no daughter products from the MEK degradation in the effluent stream.

D. TASK 4: ESTABLISH THE COST-EFFECTIVENESS OF THE DUAL-PHASE TREATMENT SYSTEM

The purpose of this economic analysis is to estimate costs for a full-scale concentrator–regenerator/biofilter treatment unit applicable at the site of study. For this particular site, the flowrate of air to be treated is 50,970 $m^3\ hr^{-1}$ (30,000 scfm). The air composition and concentration are assumed to be the same as those observed during the demonstration. The organic components of the air stream are MEK, 2-pentanone, and toluene in concentrations of 25, 13, and 7 mg m^{-3}, respectively. These values are based on the experimental TO-14 data as discussed in Task 1. Cost estimates presented in this section derive from data compiled during the demonstration, a computer algorithm for biofilter cost, independent vendor quotes, and professional engineering judgment.

1. Important Factors and Assumptions

A number of factors affect the estimated cost of treating air contaminated with organic compounds: (1) throughput rate, (2) types and concentrations of contaminants, (3) presence of water in the incoming stream, (4) air temperature, and (5) treatment goals. This analysis evaluates the effect of treatment goal on cost. It assumes the concentrator–regenerator will operate when the paint booth is in operation and the carbon becomes significantly loaded. It also assumes that the biofilter will treat contaminated air supplied continuously from the storage tanks.

This cost analysis assumes that air enters the biofilter at a flowrate of 100 scfm, is treated to a biofilter degradation efficiency of 85%, and is discharged directly to the atmosphere. Individual sites must comply with their particular air permit discharge limits on a case-by-case basis. The need for such specific compliance measures may increase the overall costs of the system compared with the analysis presented in this section. Other assumptions include (1) a system (*i.e.*, blower and air ducting) to supply air to the concentrator–regenerator/biofilter is already in place/or provided by others; (2) a concrete foundation must be constructed onsite for the concentrator–regenerator/biofilter; (3) a building to house the regenerator skid assembly must be constructed; (4) utility lines exist on-site to be connected by others; (5) the treatment system operates automatically; (6) one technician operates the equipment. Supervision/management, administration, engineering, purchasing, construction services, and equipment maintenance associated with the installation and operation of the dual treatment system are included in the lump sum costs.

2. Capital, Operating, and Net Present Value Costs of the Dual System

A cost estimate for supplying a full-scale concentrator–regenerator/biofilter is summarized in Table 2 and presents Net Present Value (NPV) costs in May, 2001, dollars with an accuracy of ±25 percent. NPVs were determined assuming a 5-year project life, an interest/inflation rate of 4 percent and a discount rate of 12 percent. Supporting information for the cost analysis is presented in Appendix F. Capital costs are free on board (FOB) Envirogen, Lawrenceville, New Jersey, and include the total installed capital above foundations for the biofilter, but exclude applicable permits, taxes, buildings, pretreatment, and routing of feed and effluent from and to up- and down-stream systems. Start-up and training costs assume completion within a 10-day period. Table 3 provides physical dimensions for the concentrator–regenerator/biofilter system.

Capital Costs

Site work consists of site preparation, improvements, and utilities, including (1) clearing and earthwork; (2) construction of foundations; (3) construction of buildings to house the regenerator equipment; (4) construction of temporary facilities; and (5) relocation of structures. Site improvements include relocation of roads, parking, curbs, gutters, walks and other hardscaping. Site utilities include water, sewer, electrical and other

ITEM DESCRIPTION	UNIT OF MEASURE	DOLLAR AMOUNT
Concentrator–Regenerator Capital Cost (+/- 25%)		
(1) Site Work (foundation)	$400/yd^3$ for 8 in. slab	$12,000
(2) Building Fabrication	$50/ft^2$	$20,000
(3) Concentrator Vessel, Regenerator System, Piping, Valves, Fittings, Control Panel, Documentation, Initial Training	Lump Sum	$711,300
(4) Component Freight	Lump Sum	$11,600
(5) Installation	Lump Sum	$49,600
TOTAL		$804,500
Concentrator–Regenerator Operating and Maintenance (O&M) Costs		
(1) Labor	$83,200/man•yr	$41,600/year
(2) Maintenance Materials	3% of Installed Capital	$24,100/year
(3) Electric Power-Regenerator Equipment	$0.06/KWH	$3,000/year
Total Annual O&M Costs		$68,700/year
Biofilter Capital Cost (+/- 25%)		
(1) Site Work (foundation)	$400/yd^3$ for 8 in. slab	$3,200
(2) Biofilter Vessel, Blower, External Humidifier, Water Feed Systems, Piping, Valves, Fittings,Control Panel, Documentation, Initial Training	Lump Sum	$60,000
(3) Component Freight	Lump Sum	$2,000
(4) Installation	Lump Sum	$5,500
TOTAL		$70,700
Biofilter Operating and Maintenance (O&M) Costs		
(1) Labor (1 hour/wk)	$83,200/man•yr	$2,080/year
(2) Maintenance Materials	1% of Installed Capital	$700/year
(3) Electric Power Blower, Pump, and Panel	$0.06/KWH	$2,600/year
(4) Water (potable and disposal costs)	$4.55/1000 gallons	$200/year
Total Annual O&M Costs		$5,580/year
NPV Costs Over 5-Year Project Life [1]		$1,174,199

[1] 5-year project life; 4% interest/inflation rate; 12% discount rate.

Table 2. Costing for the concentrator–regenerator/biofilter system (2001 dollars).

utility distribution. All work involving contaminated or hazardous material is *excluded* from this estimate. For this cost analysis, it is assumed that clearing and earthwork are not required. Foundation costs are calculated assuming a cost of $400 per cubic yard for installation of an 8-inch thick reinforced concrete pad, including footers and gravel base,

	UNITS	PARAMETERS
Concentrator Footprint	ft^2	100
Regenerator Footprint	ft^2	100
Concentrator–Regenerator Plot Plan Requirement	ft^2	400
Biofilter Footprint	ft^2	160
Biofilter Height	ft	10
Biofilter Plot Plan Requirement	ft^2	320
Foundation Loading (Minimum)	lbs/ft^2	1,300

Table 3. Dual treatment system physical details.

covering the required plot plan areas (Table 3). A cost of $50 per square foot (installed) is used as the basis for the cost of providing a building to house the regenerator skid assembly. The building area is assumed to be one-third of the dual treatment plot plan area. It is assumed that construction of temporary facilities and relocation of structures are not required.

For the capital costs associated with the actual equipment of the concentrator–regenerator/biofilter dual treatment system, a lump sum total is provided. This lump sum includes the reactor vessels, ancillary equipment and piping, operating manuals, and training. For component freight, a lump sum is provided for mobilization of equipment from the manufacturer to the site location. For this cost analysis, equipment mobilization costs are assumed to be 3.3% of the total installed dual-treatment system capital costs. Installation costs include costs for mobilization of personnel to the site for setup and oversight of equipment installation. For the concentrator–regenerator, these costs also include fabrication of the system. These costs do not include utility hookups. These are to be provided by others.

Operating Costs

The operating costs for the concentrator–regenerator/biofilter include labor, maintenance, electricity, and for water consumption and disposal (for the biofilter). Considerably more labor time (20 hrs/week) is included for the concentrator–regenerator than for the biofilter (1 hr/week), because constant supervision by an operator was necessary while the regenerator portion of the system operated during the demonstration study. The engineering model concentrator–regenerator required numerous repairs during use (which effectively included the initial shakedown), and we anticipate that additional engineering refinement will better automate the system. In the same context,

maintenance materials are listed at 3% of the total capital costs per year for the concentrator–regenerator, and only 1% for the biofilter. Electrical demand for the concentrator–regenerator is 8 kW. The concentrator–regenerator will not operate continuously, so hourly demand is estimated from experience in the field. For the biofilter, electrical demand is approximated to be 5 kW. Water demand is approximated to be 28,000 gallons per year. Biofilter water consumption was found to be significantly reduced by recycling the water through the biofilter, which had no negative impact on system performance (*e.g.*, increase in inhibitory salts).

Net Present Value (NPV) Costs

Table 2 summarizes the total treatment system costs in terms of NPV, at 100 percent on-line, to be $1.17 million. Note that the dollar totals presented do not include such cost categories as monitoring, sampling, testing, and analysis, air collection and distribution, etc., which will increase the total air treatment costs. NPVs were determined assuming a 5-year project life, an interest/inflation rate of 4 percent and a discount rate of 12 percent. Separate and combined NPV calculations can be found in Appendix F for the concentrator–regenerator and biofilter systems.

V. CONCLUSIONS

This project was a collaborative effort between Envirogen and CHA Corporation, in cooperation with Tyndall Air Force Base. The project was funded through the Small Business Innovation Research (SBIR) Program and sponsored by the Air Force Research Laboratory (AFRL/MLQ). The purpose of this research effort was to treat VOC and HAP emissions generated intermittently from a spray paint booth located at Tyndall AFB (Panama City, Florida) as a representative application to a Department of Defense coating operation. Effective biotreatment of such a transient, nonsteady-state load of organics requires that a concentrator/biofilter treatment system be implemented. This experiment provided insight as to the applicability of such a treatment system to spray paint booth operations.

Operation of the carbon concentrator–regenerator was shown to theoretically work in the laboratory, allowing for scale-up into the field. At the site, it was discovered that insufficient loading was received from the paint booth to adequately feed the biofilter reactor on a continuous basis. Additionally, numerous performance and operational problems with the field carbon concentrator–regenerator made it difficult to maintain steady-state loads into the biofilter. We engineered around problems involving poorly operating magnetrons, transformers, flowmeters, and valves. The software operating the carbon concentrator–regenerator required reprogramming several times to accommodate unforeseen problems with the system. Various pieces of equipment were replaced throughout the study with more robust pieces. In some cases where the equipment was considered ancillary to the operation of the system, the equipment was removed and no replacement was implemented.

During episodes when regenerated gases were available to the biofilter, the biofilter achieved 80% removal of the solvent-laden air. To keep the biofilter acclimated to a solvent-laden air stream, an artificial load of air containing MEK, 2-pentanone, and toluene was occasionally fed to the biofilter. In instances where this feeding occurred over a short time span (within days), the microbial population acclimated to the solvents and generally removed greater than 87% of all the solvents within the first 0.5 feet of bed depth.

To demonstrate the ability of the carbon concentrator–regenerator to work effectively in conjunction with the biofilter, the inadequate loading from the paint booth was replaced by introducing an artificial load at the beginning of the treatment train. MEK, toluene, and 2-pentanone were introduced downstream of the paint booth blower (drawing in ambient air) and upstream of the carbon adsorber unit at typical spray paint booth loading rates. Measurements showed that 4674 g as carbon entered the adsorber and 396 g exited the adsorber, providing a capture efficiency of 92%. Regeneration of the loaded carbon for 40 hours delivered 647 g of solvent to the biofilter while a net of 4278 g of solvent (extrapolated from analysis of samples of regenerated carbon) was desorbed and 385 g remained adsorbed. A survey of areas that might absorb or leak the

desorbed contaminant identified a water knockout tank, a vacuum pump, the storage tanks, and the air piping from the storage tanks to the biofilter as sinks for the regenerated solvent. It may be prudent in designing future such systems to employ alternatives for the water knockout tank and the storage tanks, and to completely avoid he use of PVC plastic piping, which we observed to have deteriorated by absorbing solvents from the air.

Of the 647 g that was regenerated and fed to the biofilter, 85% was degraded. Since the biofilter was regularly fed only MEK during the downtimes when regenerated air was not available to the biofilter, the microbial population did not have a suitable acclimation period to the toluene and 2-pentanone in the regenerated air when it was provided to the biofilter. The 15% of desorbed contaminant that passed through the system was likely these solvents.

For the recycling experiments, a critical load established at a concentration of 2000 ppmv (984 mg m^{-3}) of MEK as methane equivalents provided an overall loading rate of 9.8 g m^{-3} hr^{-1} across the entire filter bed. As a baseline for the recycling experiment study, the reactor was fed at the critical load with no recycling of air and degraded 82% of the MEK-laden air. Recycling the treated effluent at ratios of 44%, 61%, 73%, and 78% enhanced removal efficiencies to 88%, 94%, 95%, and 98%, respectively. For the critical load used in these experiments, it appears that oxygen limitations were not a factor and daughter products were not developed that inhibited or limited system performance, so recycling is a practical method of enhancing destruction efficiencies—in principle to any treatment standard.

A combined system NPV of $1.17 million was calculated on the assumption of a 5-year project life and no further engineering refinements to the engineering prototype concentration–regeneration system. Use of this treatment system as a collection point and common facility to treat emissions adsorbed into portable canisters at a number of peripherally located, small painting facilities should greatly improve the economics of application.

VI. RECOMMENDATIONS

For efficient and affordable treatment of large volumes of intermittent VOC/HAP emissions using biofiltration, a concentrator is required, both to reduce the volume of air treated, and to distribute a uniform organic load to the biofilter. The results suggest that a concentrator–regenerator followed by a biofilter is a technically feasible solution for air pollution control from a spray paint booth operation. Further design improvements are required of the concentrator–regenerator system so that it is not so operator dependent. These design improvements include further enhancement of the software program operating the system, improvements in the carbon delivery system to the regenerator, hardening of the regeneration column and improvement of accessibility, refitting the air delivery system from the regenerator to the storage tanks with solvent-resistant materials, and replacement or isolation of components containing oil or condensed water.

It would be usefull to repeat the mass balance experiment and vary the amount of energy required by the microwave regenerator to regenerate the carbon effectively. This would provide a possible cost savings if it could be determined that only two magnetrons (as opposed to four) are required to effectively regenerate the carbon.

Additional experiments are required to confirm a critical loading rate to the biofilter. A critical load was determined in this study, but this particular loading rate may have been only an intermediate step towards larger mass removal as the microbes acclimated to the solvent of interest. Longer operation of the system at this critical load would confirm this point. The recycling of the air proved effective for this application in the short term. Longer periods of biofilter operation in recycle mode could demonstrate reduced performance if the loading is increased and oxygen limitations become critical. Only a single component (MEK) was used for the recycling study. Another component or a multicomponent stream may promote oxygen limitation, create daughter products, and/or change the bed conditions (pH, microbe type, etc.). Additional extensive research will be required to assess the variables associated with recycling the effluent air stream through a biofilter.

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APPENDIX A

TO-14 SPECIATED CONTAMINANT ANALYSIS

LABSAMPID	LABCODE	MATRIX	METHOD	CLIENTSAMPID	SAMPDATE	ANALDATE	ANALTIME	LABCTLID	DILUTION	REPLMT	UNITS	RESULT	DATAFLAGS	COMPOUND NAME	CAS#
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	82	PPBV		ND	Freon 12	75-71-8
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	82	PPBV		ND	Freon 114	76-14-2
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	82	PPBV		ND	Chloromethane	74-87-3
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	82	PPBV		ND	Vinyl Chloride	75-01-4
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	82	PPBV		ND	Bromomethane	74-83-9
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	82	PPBV		ND	Chloroethane	75-00-3
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	82	PPBV		ND	Freon 11	75-69-4
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	82	PPBV		ND	1,1-Dichloroethene	75-35-4
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	82	PPBV	110		Freon 113	76-13-1
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	82	PPBV	96		Methylene Chloride	75-09-2
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	82	PPBV		ND	1,1-Dichloroethane	75-34-3
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	82	PPBV	190		cis-1,2-Dichloroethene	156-59-2
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	82	PPBV		ND	Chloroform	67-66-3
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	82	PPBV	280		1,1,1-Trichloroethane	71-55-6
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	82	PPBV		ND	Carbon Tetrachloride	56-23-5
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	82	PPBV		ND	Benzene	71-43-2
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	82	PPBV		ND	1,2-Dichloroethane	107-06-2
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	82	PPBV	420		Trichloroethene	79-01-6
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	82	PPBV		ND	1,2-Dichloropropane	78-87-5
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	82	PPBV		ND	cis-1,3-Dichloropropene	10061-01-5
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	82	PPBV	3500		Toluene	108-88-3
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	82	PPBV		ND	trans-1,3-Dichloropropene	10061-02-6
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	82	PPBV		ND	1,1,2-Trichloroethane	79-00-5
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	82	PPBV	170		Tetrachloroethene	127-18-4
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	82	PPBV		ND	Ethylene Dibromide	106-93-4
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	82	PPBV		ND	Chlorobenzene	108-90-7
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	82	PPBV	350		Ethyl Benzene	100-41-4
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	82	PPBV	1200		m,p-Xylene	108-38-3/106-42-3
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	82	PPBV	410		o-Xylene	95-47-6
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	82	PPBV	140		Styrene	100-42-5
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	82	PPBV		ND	1,1,2,2-Tetrachloroethane	79-34-5
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	82	PPBV		ND	1,3,5-Trimethylbenzene	108-67-8
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	82	PPBV	160		1,2,4-Trimethylbenzene	95-63-6
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	82	PPBV		ND	1,3-Dichlorobenzene	541-73-1
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	82	PPBV		ND	1,4-Dichlorobenzene	106-46-7
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	82	PPBV		ND	Chlorotoluene	100-44-7
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	82	PPBV		ND	1,2-Dichlorobenzene	95-50-1
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	82	PPBV		ND	1,2,4-Trichlorobenzene	120-82-1
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	82	PPBV		ND	Hexachlorobutadiene	87-68-3
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	330	PPBV		ND	Propylene	115-07-1
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	330	PPBV		ND	1,3-Butadiene	106-99-0
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	330	PPBV		ND	Acetone	67-64-1
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	330	PPBV		ND	Carbon Disulfide	75-15-0
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	330	PPBV		ND	2-Propanol	67-63-0
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	330	PPBV		ND	trans-1,2-Dichloroethene	156-60-5
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	330	PPBV		ND	Vinyl Acetate	108-05-4
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	330	PPBV	14000		2-Butanone (Methyl Ethyl Keton	78-93-3
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	330	PPBV		ND	Hexane	110-54-3
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	330	PPBV		ND	Tetrahydrofuran	109-99-9
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	330	PPBV		ND	Cyclohexane	110-82-7
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	330	PPBV		ND	1,4-Dioxane	123-91-1
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	330	PPBV		ND	Bromodichloromethane	75-27-4
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	330	PPBV		ND	4-Methyl-2-pentanone	108-10-1
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	330	PPBV		ND	2-Hexanone	591-78-6
LABSAMPID	LABCODE	MATRIX	METHOD	CLIENTSAMPID	SAMPDATE	ANALDATE	ANALTIME	LABCTLID	DILUTION	REPLMT	UNITS	RESULT	DATAFLAGS	COMPOUND NAME	CAS#

9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	330	PPBV		ND	Dibromochloromethane	124-48-1
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	330	PPBV		ND	Bromoform	75-25-2
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	330	PPBV		ND	4-Ethyltoluene	622-96-8
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	330	PPBV		ND	Ethanol	64-17-5
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	330	PPBV		ND	Methyl tert-Butyl Ether	1634-04-4
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164	330	PPBV		ND	Heptane	142-82-5
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164		PPBV	2500		Unknown	NA
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164		PPBV	6600		2-Pentanone	107-87-9
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164		PPBV	3400		Acetic acid, butyl ester	123-86-4
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164		PPBV	610		1-Pentanol, 2-methyl-, acetate	7789-99-3
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164		PPBV	910		Unknown	NA
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164		PPBV	1600		Unknown	NA
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164		PPBV	2000		Acetic acid, heptyl ester	112-06-1
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164		%R	99		1,2-Dichloroethane-d4	17060-07-0
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164		%R	102		Toluene-d8	2037-26-5
9907135-01A	ATL	AIR	TO-14	BF-1-Prime	07/07/99	07/20/99	1549	cb072001	164		%R	96		4-Bromofluorobenzene	460-00-4
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	84	PPBV		ND	Freon 12	75-71-8
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	84	PPBV		ND	Freon 114	76-14-2
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	84	PPBV		ND	Chloromethane	74-87-3
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	84	PPBV		ND	Vinyl Chloride	75-01-4
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	84	PPBV		ND	Bromomethane	74-83-9
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	84	PPBV		ND	Chloroethane	75-00-3
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	84	PPBV		ND	Freon 11	75-69-4
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	84	PPBV		ND	1,1-Dichloroethene	75-35-4
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	84	PPBV	140		Freon 113	76-13-1
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	84	PPBV		ND	Methylene Chloride	75-09-2
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	84	PPBV		ND	1,1-Dichloroethane	75-34-3
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	84	PPBV	200		cis-1,2-Dichloroethene	156-59-2
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	84	PPBV		ND	Chloroform	67-66-3
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	84	PPBV	360		1,1,1-Trichloroethane	71-55-6
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	84	PPBV		ND	Carbon Tetrachloride	56-23-5
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	84	PPBV		ND	Benzene	71-43-2
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	84	PPBV		ND	1,2-Dichloroethane	107-06-2
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	84	PPBV	440		Trichloroethene	79-01-6
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	84	PPBV		ND	1,2-Dichloropropane	78-87-5
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	84	PPBV		ND	cis-1,3-Dichloropropene	10061-01-5
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	84	PPBV	3500		Toluene	108-88-3
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	84	PPBV		ND	trans-1,3-Dichloropropene	10061-02-6
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	84	PPBV		ND	1,1,2-Trichloroethane	79-00-5
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	84	PPBV	170		Tetrachloroethene	127-18-4
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	84	PPBV		ND	Ethylene Dibromide	106-93-4
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	84	PPBV		ND	Chlorobenzene	108-90-7
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	84	PPBV	340		Ethyl Benzene	100-41-4
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	84	PPBV	1100		m,p-Xylene	108-38-3/106-42-3
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	84	PPBV	410		o-Xylene	95-47-6
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	84	PPBV	110		Styrene	100-42-5
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	84	PPBV		ND	1,1,2,2-Tetrachloroethane	79-34-5
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	84	PPBV		ND	1,3,5-Trimethylbenzene	108-67-8
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	84	PPBV	170		1,2,4-Trimethylbenzene	95-63-6
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	84	PPBV		ND	1,3-Dichlorobenzene	541-73-1
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	84	PPBV		ND	1,4-Dichlorobenzene	106-46-7
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	84	PPBV		ND	Chlorotoluene	100-44-7
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	84	PPBV		ND	1,2-Dichlorobenzene	95-50-1
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	84	PPBV		ND	1,2,4-Trichlorobenzene	120-82-1
LABSAMPID	LABCODE	MATRIX	METHOD	CLIENTSAMPID	SAMPDATE	ANALDATE	ANALTIME	LABCTLID	DILUTION	REPLMT	UNITS	RESULT	DATAFLAGS	COMPOUND NAME	CAS#
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	84	PPBV		ND	Hexachlorobutadiene	87-68-3

9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	340	PPBV		ND	Propylene	115-07-1
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	340	PPBV		ND	1,3-Butadiene	106-99-0
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	340	PPBV		ND	Acetone	67-64-1
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	340	PPBV		ND	Carbon Disulfide	75-15-0
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	340	PPBV		ND	2-Propanol	67-63-0
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	340	PPBV		ND	trans-1,2-Dichloroethene	156-60-5
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	340	PPBV		ND	Vinyl Acetate	108-05-4
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	340	PPBV	14000		2-Butanone (Methyl Ethyl Keton	78-93-3
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	340	PPBV		ND	Hexane	110-54-3
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	340	PPBV		ND	Tetrahydrofuran	109-99-9
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	340	PPBV		ND	Cyclohexane	110-82-7
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	340	PPBV		ND	1,4-Dioxane	123-91-1
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	340	PPBV		ND	Bromodichloromethane	75-27-4
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	340	PPBV		ND	4-Methyl-2-pentanone	108-10-1
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	340	PPBV		ND	2-Hexanone	591-78-6
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	340	PPBV		ND	Dibromochloromethane	124-48-1
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	340	PPBV		ND	Bromoform	75-25-2
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	340	PPBV		ND	4-Ethyltoluene	622-96-8
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	340	PPBV		ND	Ethanol	64-17-5
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	340	PPBV		ND	Methyl tert-Butyl Ether	1634-04-4
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168	340	PPBV		ND	Heptane	142-82-5
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168		PPBV	2600		Unknown	NA
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168		PPBV	6900		2-Pentanone	107-87-9
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168		PPBV	3400		Acetic acid, butyl ester	123-86-4
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168		PPBV	640		Unknown	NA
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168		PPBV	1000		Unknown	NA
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168		PPBV	1800		Unknown	NA
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168		PPBV	1900		Acetic acid, heptyl ester	112-06-1
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168		%R	99		1,2-Dichloroethane-d4	17060-07-0
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168		%R	101		Toluene-d8	2037-26-5
9907135-02A	ATL	AIR	TO-14	BF-2-Prime	07/07/99	07/20/99	1628	cb072001	168		%R	92		4-Bromofluorobenzene	460-00-4
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	11	PPBV		ND	Freon 12	75-71-8
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	11	PPBV		ND	Freon 114	76-14-2
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	11	PPBV		ND	Chloromethane	74-87-3
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	11	PPBV		ND	Vinyl Chloride	75-01-4
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	11	PPBV		ND	Bromomethane	74-83-9
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	11	PPBV		ND	Chloroethane	75-00-3
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	11	PPBV		ND	Freon 11	75-69-4
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	11	PPBV		ND	1,1-Dichloroethene	75-35-4
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	11	PPBV		ND	Freon 113	76-13-1
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	11	PPBV		ND	Methylene Chloride	75-09-2
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	11	PPBV		ND	1,1-Dichloroethane	75-34-3
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	11	PPBV		ND	cis-1,2-Dichloroethene	156-59-2
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	11	PPBV		ND	Chloroform	67-66-3
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	11	PPBV		ND	1,1,1-Trichloroethane	71-55-6
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	11	PPBV		ND	Carbon Tetrachloride	56-23-5
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	11	PPBV		ND	Benzene	71-43-2
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	11	PPBV		ND	1,2-Dichloroethane	107-06-2
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	11	PPBV		ND	Trichloroethene	79-01-6
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	11	PPBV		ND	1,2-Dichloropropane	78-87-5
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	11	PPBV		ND	cis-1,3-Dichloropropene	10061-01-5
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	11	PPBV	360		Toluene	108-88-3
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	11	PPBV		ND	trans-1,3-Dichloropropene	10061-02-6
LABSAMPID	LABCODE	MATRIX	METHOD	CLIENTSAMPID	SAMPDATE	ANALDATE	ANALTIME	LABCTLID	DILUTION	REPLMT	UNITS	RESULT	DATAFLAGS	COMPOUND NAME	CAS#
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	11	PPBV		ND	1,1,2-Trichloroethane	79-00-5
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	11	PPBV		ND	Tetrachloroethene	127-18-4

9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	11	PPBV		ND	Ethylene Dibromide	106-93-4
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	11	PPBV		ND	Chlorobenzene	108-90-7
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	11	PPBV	56		Ethyl Benzene	100-41-4
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	11	PPBV	240		m,p-Xylene	108-38-3/106-42-3
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	11	PPBV	73		o-Xylene	95-47-6
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	11	PPBV		ND	Styrene	100-42-5
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	11	PPBV		ND	1,1,2,2-Tetrachloroethane	79-34-5
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	11	PPBV	57		1,3,5-Trimethylbenzene	108-67-8
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	11	PPBV	160		1,2,4-Trimethylbenzene	95-63-6
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	11	PPBV		ND	1,3-Dichlorobenzene	541-73-1
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	11	PPBV		ND	1,4-Dichlorobenzene	106-46-7
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	11	PPBV		ND	Chlorotoluene	100-44-7
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	11	PPBV		ND	1,2-Dichlorobenzene	95-50-1
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	11	PPBV		ND	1,2,4-Trichlorobenzene	120-82-1
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	11	PPBV		ND	Hexachlorobutadiene	87-68-3
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	46	PPBV		ND	Propylene	115-07-1
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	46	PPBV		ND	1,3-Butadiene	106-99-0
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	46	PPBV		ND	Acetone	67-64-1
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	46	PPBV		ND	Carbon Disulfide	75-15-0
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	46	PPBV		ND	2-Propanol	67-63-0
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	46	PPBV		ND	trans-1,2-Dichloroethene	156-60-5
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	46	PPBV		ND	Vinyl Acetate	108-05-4
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	46	PPBV	2600		2-Butanone (Methyl Ethyl Keton	78-93-3
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	46	PPBV		ND	Hexane	110-54-3
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	46	PPBV		ND	Tetrahydrofuran	109-99-9
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	46	PPBV		ND	Cyclohexane	110-82-7
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	46	PPBV		ND	1,4-Dioxane	123-91-1
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	46	PPBV		ND	Bromodichloromethane	75-27-4
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	46	PPBV	1700		4-Methyl-2-pentanone	108-10-1
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	46	PPBV		ND	2-Hexanone	591-78-6
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	46	PPBV		ND	Dibromochloromethane	124-48-1
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	46	PPBV		ND	Bromoform	75-25-2
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	46	PPBV	220		4-Ethyltoluene	622-96-8
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	46	PPBV	65		Ethanol	64-17-5
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	46	PPBV		ND	Methyl tert-Butyl Ether	1634-04-4
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8	46	PPBV		ND	Heptane	142-82-5
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8		PPBV	19000		Unknown	NA
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8		PPBV	10000		Acetic acid, butyl ester	123-86-4
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8		PPBV	7000		2-Heptanone	110-43-0
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8		PPBV	3900		Propanoic acid, 3-ethoxy-, ethyl	763-69-9
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8		%R	103		1,2-Dichloroethane-d4	17060-07-0
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8		%R	98		Toluene-d8	2037-26-5
9907135-03A	ATL	AIR	TO-14	BF-3-Paint	07/07/99	07/20/99	0100	cb071901	22.8		%R	97		4-Bromofluorobenzene	460-00-4
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	11	PPBV		ND	Freon 12	75-71-8
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	11	PPBV		ND	Freon 114	76-14-2
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	11	PPBV		ND	Chloromethane	74-87-3
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	11	PPBV		ND	Vinyl Chloride	75-01-4
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	11	PPBV		ND	Bromomethane	74-83-9
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	11	PPBV		ND	Chloroethane	75-00-3
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	11	PPBV		ND	Freon 11	75-69-4
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	11	PPBV		ND	1,1-Dichloroethene	75-35-4
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	11	PPBV		ND	Freon 113	76-13-1
LABSAMPID	LABCODE	MATRIX	METHOD	CLIENTSAMPID	SAMPDATE	ANALDATE	ANALTIME	LABCTLID	DILUTION	REPLMT	UNITS	RESULT	DATAFLAGS	COMPOUND NAME	CAS#
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	11	PPBV		ND	Methylene Chloride	75-09-2
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	11	PPBV		ND	1,1-Dichloroethane	75-34-3
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	11	PPBV		ND	cis-1,2-Dichloroethene	156-59-2

9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	11	PPBV		ND	Chloroform	67-66-3
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	11	PPBV		ND	1,1,1-Trichloroethane	71-55-6
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	11	PPBV		ND	Carbon Tetrachloride	56-23-5
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	11	PPBV		ND	Benzene	71-43-2
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	11	PPBV		ND	1,2-Dichloroethane	107-06-2
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	11	PPBV		ND	Trichloroethene	79-01-6
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	11	PPBV		ND	1,2-Dichloropropane	78-87-5
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	11	PPBV		ND	cis-1,3-Dichloropropene	10061-01-5
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	11	PPBV	370		Toluene	108-88-3
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	11	PPBV		ND	trans-1,3-Dichloropropene	10061-02-6
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	11	PPBV		ND	1,1,2-Trichloroethane	79-00-5
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	11	PPBV		ND	Tetrachloroethene	127-18-4
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	11	PPBV		ND	Ethylene Dibromide	106-93-4
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	11	PPBV		ND	Chlorobenzene	108-90-7
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	11	PPBV	57		Ethyl Benzene	100-41-4
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	11	PPBV	250		m,p-Xylene	108-38-3/106-42-3
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	11	PPBV	76		o-Xylene	95-47-6
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	11	PPBV		ND	Styrene	100-42-5
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	11	PPBV		ND	1,1,2,2-Tetrachloroethane	79-34-5
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	11	PPBV	66		1,3,5-Trimethylbenzene	108-67-8
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	11	PPBV	210		1,2,4-Trimethylbenzene	95-63-6
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	11	PPBV		ND	1,3-Dichlorobenzene	541-73-1
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	11	PPBV		ND	1,4-Dichlorobenzene	106-46-7
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	11	PPBV		ND	Chlorotoluene	100-44-7
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	11	PPBV		ND	1,2-Dichlorobenzene	95-50-1
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	11	PPBV		ND	1,2,4-Trichlorobenzene	120-82-1
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	11	PPBV		ND	Hexachlorobutadiene	87-68-3
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	45	PPBV		ND	Propylene	115-07-1
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	45	PPBV		ND	1,3-Butadiene	106-99-0
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	45	PPBV		ND	Acetone	67-64-1
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	45	PPBV		ND	Carbon Disulfide	75-15-0
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	45	PPBV		ND	2-Propanol	67-63-0
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	45	PPBV		ND	trans-1,2-Dichloroethene	156-60-5
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	45	PPBV		ND	Vinyl Acetate	108-05-4
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	45	PPBV	2700		2-Butanone (Methyl Ethyl Keton	78-93-3
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	45	PPBV		ND	Hexane	110-54-3
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	45	PPBV		ND	Tetrahydrofuran	109-99-9
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	45	PPBV		ND	Cyclohexane	110-82-7
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	45	PPBV		ND	1,4-Dioxane	123-91-1
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	45	PPBV		ND	Bromodichloromethane	75-27-4
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	45	PPBV	1700		4-Methyl-2-pentanone	108-10-1
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	45	PPBV		ND	2-Hexanone	591-78-6
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	45	PPBV		ND	Dibromochloromethane	124-48-1
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	45	PPBV		ND	Bromoform	75-25-2
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	45	PPBV	250		4-Ethyltoluene	622-96-8
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	45	PPBV	70		Ethanol	64-17-5
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	45	PPBV		ND	Methyl tert-Butyl Ether	1634-04-4
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4	45	PPBV		ND	Heptane	142-82-5
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4		PPBV	19000		Unknown	NA
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4		PPBV	10000		Acetic acid, butyl ester	123-86-4
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4		PPBV	4600		Propanoic acid, 3-ethoxy-, ethyl	763-69-9
LABSAMPID	LABCODE	MATRIX	METHOD	CLIENTSAMPID	SAMPDATE	ANALDATE	ANALTIME	LABCTLID	DILUTION	REPLMT	UNITS	RESULT	DATAFLAGS	COMPOUND NAME	CAS#
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4		%R	104		1,2-Dichloroethane-d4	17060-07-0
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4		%R	100		Toluene-d8	2037-26-5
9907135-04A	ATL	AIR	TO-14	BF-4-Paint	07/07/99	07/20/99	0139	cb071901	22.4		%R	98		4-Bromofluorobenzene	460-00-4
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	0.50	PPBV		ND	Freon 12	75-71-8

9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	0.50	PPBV		ND	Freon 114	76-14-2
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	0.50	PPBV		ND	Chloromethane	74-87-3
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	0.50	PPBV		ND	Vinyl Chloride	75-01-4
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	0.50	PPBV		ND	Bromomethane	74-83-9
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	0.50	PPBV		ND	Chloroethane	75-00-3
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	0.50	PPBV		ND	Freon 11	75-69-4
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	0.50	PPBV		ND	1,1-Dichloroethene	75-35-4
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	0.50	PPBV		ND	Freon 113	76-13-1
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	0.50	PPBV		ND	Methylene Chloride	75-09-2
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	0.50	PPBV		ND	1,1-Dichloroethane	75-34-3
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	0.50	PPBV		ND	cis-1,2-Dichloroethene	156-59-2
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	0.50	PPBV		ND	Chloroform	67-66-3
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	0.50	PPBV		ND	1,1,1-Trichloroethane	71-55-6
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	0.50	PPBV		ND	Carbon Tetrachloride	56-23-5
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	0.50	PPBV		ND	Benzene	71-43-2
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	0.50	PPBV		ND	1,2-Dichloroethane	107-06-2
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	0.50	PPBV		ND	Trichloroethene	79-01-6
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	0.50	PPBV		ND	1,2-Dichloropropane	78-87-5
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	0.50	PPBV		ND	cis-1,3-Dichloropropene	10061-01-5
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	0.50	PPBV		ND	Toluene	108-88-3
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	0.50	PPBV		ND	trans-1,3-Dichloropropene	10061-02-6
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	0.50	PPBV		ND	1,1,2-Trichloroethane	79-00-5
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	0.50	PPBV		ND	Tetrachloroethene	127-18-4
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	0.50	PPBV		ND	Ethylene Dibromide	106-93-4
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	0.50	PPBV		ND	Chlorobenzene	108-90-7
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	0.50	PPBV		ND	Ethyl Benzene	100-41-4
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	0.50	PPBV		ND	m,p-Xylene	108-38-3/106-42-3
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	0.50	PPBV		ND	o-Xylene	95-47-6
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	0.50	PPBV		ND	Styrene	100-42-5
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	0.50	PPBV		ND	1,1,2,2-Tetrachloroethane	79-34-5
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	0.50	PPBV		ND	1,3,5-Trimethylbenzene	108-67-8
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	0.50	PPBV		ND	1,2,4-Trimethylbenzene	95-63-6
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	0.50	PPBV		ND	1,3-Dichlorobenzene	541-73-1
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	0.50	PPBV		ND	1,4-Dichlorobenzene	106-46-7
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	0.50	PPBV		ND	Chlorotoluene	100-44-7
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	0.50	PPBV		ND	1,2-Dichlorobenzene	95-50-1
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	0.50	PPBV		ND	1,2,4-Trichlorobenzene	120-82-1
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	0.50	PPBV		ND	Hexachlorobutadiene	87-68-3
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	2.0	PPBV		ND	Propylene	115-07-1
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	2.0	PPBV		ND	1,3-Butadiene	106-99-0
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	2.0	PPBV		ND	Acetone	67-64-1
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	2.0	PPBV		ND	Carbon Disulfide	75-15-0
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	2.0	PPBV		ND	2-Propanol	67-63-0
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	2.0	PPBV		ND	trans-1,2-Dichloroethene	156-60-5
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	2.0	PPBV		ND	Vinyl Acetate	108-05-4
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	2.0	PPBV		ND	2-Butanone (Methyl Ethyl Keton	78-93-3
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	2.0	PPBV		ND	Hexane	110-54-3
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	2.0	PPBV		ND	Tetrahydrofuran	109-99-9
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	2.0	PPBV		ND	Cyclohexane	110-82-7
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	2.0	PPBV		ND	1,4-Dioxane	123-91-1
LABSAMPID	LABCODE	MATRIX	METHOD	CLIENTSAMPID	SAMPDATE	ANALDATE	ANALTIME	LABCTLID	DILUTION	REPLMT	UNITS	RESULT	DATAFLAGS	COMPOUND NAME	CAS#
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	2.0	PPBV		ND	Bromodichloromethane	75-27-4
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	2.0	PPBV		ND	4-Methyl-2-pentanone	108-10-1
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	2.0	PPBV		ND	2-Hexanone	591-78-6
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	2.0	PPBV		ND	Dibromochloromethane	124-48-1
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	2.0	PPBV		ND	Bromoform	75-25-2

9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	2.0	PPBV		ND	4-Ethyltoluene	622-96-8
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	2.0	PPBV		ND	Ethanol	64-17-5
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	2.0	PPBV		ND	Methyl tert-Butyl Ether	1634-04-4
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00	2.0	PPBV		ND	Heptane	142-82-5
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00		%R	99		1,2-Dichloroethane-d4	17060-07-0
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00		%R	104		Toluene-d8	2037-26-5
9907135-05A	ATL	AIR	TO-14	Lab Blank		07/19/99	0739	cb071901	1.00		%R	90		4-Bromofluorobenzene	460-00-4
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	0.50	PPBV		ND	Freon 12	75-71-8
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	0.50	PPBV		ND	Freon 114	76-14-2
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	0.50	PPBV		ND	Chloromethane	74-87-3
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	0.50	PPBV		ND	Vinyl Chloride	75-01-4
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	0.50	PPBV		ND	Bromomethane	74-83-9
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	0.50	PPBV		ND	Chloroethane	75-00-3
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	0.50	PPBV		ND	Freon 11	75-69-4
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	0.50	PPBV		ND	1,1-Dichloroethene	75-35-4
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	0.50	PPBV		ND	Freon 113	76-13-1
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	0.50	PPBV		ND	Methylene Chloride	75-09-2
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	0.50	PPBV		ND	1,1-Dichloroethane	75-34-3
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	0.50	PPBV		ND	cis-1,2-Dichloroethene	156-59-2
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	0.50	PPBV		ND	Chloroform	67-66-3
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	0.50	PPBV		ND	1,1,1-Trichloroethane	71-55-6
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	0.50	PPBV		ND	Carbon Tetrachloride	56-23-5
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	0.50	PPBV		ND	Benzene	71-43-2
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	0.50	PPBV		ND	1,2-Dichloroethane	107-06-2
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	0.50	PPBV		ND	Trichloroethene	79-01-6
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	0.50	PPBV		ND	1,2-Dichloropropane	78-87-5
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	0.50	PPBV		ND	cis-1,3-Dichloropropene	10061-01-5
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	0.50	PPBV		ND	Toluene	108-88-3
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	0.50	PPBV		ND	trans-1,3-Dichloropropene	10061-02-6
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	0.50	PPBV		ND	1,1,2-Trichloroethane	79-00-5
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	0.50	PPBV		ND	Tetrachloroethene	127-18-4
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	0.50	PPBV		ND	Ethylene Dibromide	106-93-4
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	0.50	PPBV		ND	Chlorobenzene	108-90-7
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	0.50	PPBV		ND	Ethyl Benzene	100-41-4
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	0.50	PPBV		ND	m,p-Xylene	108-38-3/106-42-3
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	0.50	PPBV		ND	o-Xylene	95-47-6
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	0.50	PPBV		ND	Styrene	100-42-5
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	0.50	PPBV		ND	1,1,2,2-Tetrachloroethane	79-34-5
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	0.50	PPBV		ND	1,3,5-Trimethylbenzene	108-67-8
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	0.50	PPBV		ND	1,2,4-Trimethylbenzene	95-63-6
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	0.50	PPBV		ND	1,3-Dichlorobenzene	541-73-1
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	0.50	PPBV		ND	1,4-Dichlorobenzene	106-46-7
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	0.50	PPBV		ND	Chlorotoluene	100-44-7
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	0.50	PPBV		ND	1,2-Dichlorobenzene	95-50-1
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	0.50	PPBV		ND	1,2,4-Trichlorobenzene	120-82-1
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	0.50	PPBV		ND	Hexachlorobutadiene	87-68-3
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	2.0	PPBV		ND	Propylene	115-07-1
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	2.0	PPBV		ND	1,3-Butadiene	106-99-0
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	2.0	PPBV		ND	Acetone	67-64-1
LABSAMPID	LABCODE	MATRIX	METHOD	CLIENTSAMPID	SAMPDATE	ANALDATE	ANALTIME	LABCTLID	DILUTION	REPLMT	UNITS	RESULT	DATAFLAGS	COMPOUND NAME	CAS#
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	2.0	PPBV		ND	Carbon Disulfide	75-15-0
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	2.0	PPBV		ND	2-Propanol	67-63-0
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	2.0	PPBV		ND	trans-1,2-Dichloroethene	156-60-5
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	2.0	PPBV		ND	Vinyl Acetate	108-05-4
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	2.0	PPBV		ND	2-Butanone (Methyl Ethyl Keton	78-93-3
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	2.0	PPBV		ND	Hexane	110-54-3

9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	2.0	PPBV		ND	Tetrahydrofuran	109-99-9
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	2.0	PPBV		ND	Cyclohexane	110-82-7
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	2.0	PPBV		ND	1,4-Dioxane	123-91-1
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	2.0	PPBV		ND	Bromodichloromethane	75-27-4
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	2.0	PPBV		ND	4-Methyl-2-pentanone	108-10-1
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	2.0	PPBV		ND	2-Hexanone	591-78-6
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	2.0	PPBV		ND	Dibromochloromethane	124-48-1
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	2.0	PPBV		ND	Bromoform	75-25-2
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	2.0	PPBV		ND	4-Ethyltoluene	622-96-8
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	2.0	PPBV		ND	Ethanol	64-17-5
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	2.0	PPBV		ND	Methyl tert-Butyl Ether	1634-04-4
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00	2.0	PPBV		ND	Heptane	142-82-5
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00		%R	96		1,2-Dichloroethane-d4	17060-07-0
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00		%R	105		Toluene-d8	2037-26-5
9907135-05B	ATL	AIR	TO-14	Lab Blank		07/20/99	0708	cb072001	1.00		%R	88		4-Bromofluorobenzene	460-00-4

APPENDIX B

SYSTEM PROBLEM DECRIPTIONS AND DAILY SHEETS

MICROWAVE CONCENTRATOR/BIOFILTER PROJECT
WEEKLY ANALOG DATA SUMMARY
Tyndall AFB (Project # 78204)
Data for week ending:___5-5-00___

PARAMETER	MON.	WED.	THUR.	FRI.	COMMENTS
Time of Day Measurements are Taken	6:00 PM	5:15 PM	4:00 PM	4:30 PM	
FE101-Differential Pressure ("WC)	2.2	2.2	2.2	2.2	
TI101- Inlet Air Temperature (degrees C)	24	24.5	25	25	
DPI 102- Pressure Across Biofilter ("WC)	0	0	0	0	
PI 105- Pressure of Inlet Water (psi)	55	50	50	50	
PI 103- Regulated Water Pressure (psi)	30	28	28	28	
FQI 101- Flow Totalizer to T-102 (gallons)	5420.5	5420.5	5420.5	5420.5	
FQI 102- Flow Totalizer to Humidifier T101 (gallons)	63023	63263	63285	63308	
FQI 103- Flow Totalizer to Sprinklers (gallons)	13897	13939	13960	13981	
FQI 104- Flow Totalizer to Weep Hoses (gallons)	9230.5	9250.5	9261	9272	
PI 110- Inlet Pressure Before FQI 103 and 104 (psi)	0	0	0	0	
TI 102- Temperature of Biofilter (degrees C)	23	24	25	25	
PI104- Water Pressure before Pump 102 (psi)	0	0	0	0	
PI102- Water Pressure after Pump 102 (psi)	0	0	0	0	
Inlet Concentration to Carbon Tank (ppmv)		34	40	45	
Outlet Concentration to Carbon Tank (ppmv)					
Inlet Concentration to Biofilter (ppmv)					
Outlet Concentration to Carbon Tank (ppmv)					

MICROWAVE CONCENTRATOR/BIOFILTER PROJECT
WEEKLY ANALOG DATA SUMMARY
Tyndall AFB (Project # 78204)
Data for week ending:________5-12-00

PARAMETER	MON.	WED.	FRI.	COMMENTS
Time of Day Measurements are Taken	5:00 PM	5:15 PM	4:00 PM	
FE101-Differential Pressure ("WC)	2.2	2.2	2.2	
TI101- Inlet Air Temperature (degrees C)	25.5	27	28.5	
DPI 102- Pressure Across Biofilter ("WC)	0	0	0	
PI 105- Pressure of Inlet Water (psi)	50	50	60	
PI 103- Regulated Water Pressure (psi)	27	29	28	
FQI 101- Flow Totalizer to T-102 (gallons)	5420.5	5420.5	5514	*****
FQI 102- Flow Totalizer to Humidifier T101 (gallons)	63378	63491	63538	
FQI 103- Flow Totalizer to Sprinklers (gallons)	14044	14086	14524	*******
FQI 104- Flow Totalizer to Weep Hoses (gallons)	9305	9336	9530	*******
PI 110- Inlet Pressure Before FQI 103 and 104 (psi)	0	0	0	
TI 102- Temperature of Biofilter (degrees C)	26	27	29	
PI104- Water Pressure before Pump 102 (psi)	0	0	0	
PI102- Water Pressure after Pump 102 (psi)	0	0	0	
Inlet Concentration to Carbon Tank (ppmv)	20			
Outlet Concentration to Carbon Tank (ppmv)	6			
Inlet Concentration to Biofilter (ppmv)	33.4	20	15	
Outlet Concentration to Carbon Tank (ppmv)	8.6	9.9	7	

MICROWAVE CONCENTRATOR/BIOFILTER PROJECT
WEEKLY ANALOG DATA SUMMARY
Tyndall AFB (Project # 78204)
Datafor week ending May 19, 2000

PARAMETER	MON.	WED.	THU.	FRI.	COMMENTS
Time of Day Measurements are Taken	5:00 PM	5:30PM	5:00 PM	5:30PM	
FE101-Differential Pressure ("WC)	2.2	2.2	2.2	2.2	
TI101-Inlet Air Temperature (degrees C)	25	26.5	27	27.5	
DPI 102- Pressure Across Biofilter ("WC)	0	0	0	0	
PI 105- Pressure of Inlet Water (psi)	60	55	55	55	
PI 103- Regulated Water Pressure (psi)	30	28	28	28	
FQI 101- Flow Totalizer to T-102 (gallons)	5514	5560	5598	5600	WED. FV107 to 15 min
FQI 102- Flow Totalizer to Humidifier T101 (gallons)	63616	63665	63699	63713	
FQI 103- Flow Totalizer to Sprinklers (gallons)	14587	14639	14650	14671	
FQI 104- Flow Totalizer to Weep Hoses (gallons)	9562	9583	9594	9605	
PI 110- Inlet Pressure Before FQI 103 and 104 (psi)	0	0	0	0	
TI 102- Temperature of Biofilter (degrees C)	24	26	26.5	27	
PI104- Water Pressure before Pump 102 (psi)	0	0	0	0	
PI102- Water Pressure after Pump 102 (psi)	0	0	0	0	
Inlet Concentration to Carbon Tank (ppmv)					
Outlet Concentration of Carbon Tank (ppmv)					
Inlet Concentration to Biofilter (ppmv)	12	13	45	13	
Outlet Concentration of Biofilter (ppmv)	4.6	5	40	1.2	

MICROWAVE CONCENTRATOR/BIOFILTER PROJECT
WEEKLY ANALOG DATA SUMMARY
Tyndall AFB (Project # 78204)
Data for week ending May 26, 2000

PARAMETER	MON.	TUES.	WED.	FRI.
Time of day Measurements are Taken	5:45PM	5:30PM	5:30PM	5:30PM
FE101-Differential Pressure ("WC)	2.2	2.2	2.2	2.2
TI101-Inlet Air Temperature (degrees C)	27	28	28	29
DPI 102- Pressure Across Biofilter ("WC)	0	0	0	0
PI 105- Pressure of Inlet Water (psi)	55	55	55	55
PI 103- Regulated Water Pressure (psi)	28	28	28	28
FQI 101- Flow Totalizer to T-102 (gallons)	5606	5608	5619	5639
FQI 102- Flow Totalizer to Humidifier T101 (gallons)	63786	63811	63835	63883
FQI 103- Flow Totalizer to Sprinklers (gallons)	14734	14754	14775	14839
FQI 104- Flow Totalizer to Weep Hoses (gallons)	9637	9648	9659	9686
PI 110- Inlet Pressure Before FQI 103 and 104 (psi)	0	0	0	0
TI 102- Temperature of Biofilter (degrees C)	29	29	30	31
PI104- Water Pressure before Pump 102 (psi)	0	0	0	0
PI102- Water Pressure after Pump 102 (psi)	0	0	0	0
Inlet Concentration to Carbon Tank (ppmv)				
Outlet Concentration of Carbon Tank (ppmv)				
Inlet Concentration to Biofilter (ppmv)	42	48	42	42
Outlet Concentration of Biofilter (ppmv)	11.5	12.2	4.8	17.5
Note: Changes to 6, 6, 0, 17 were made after 5:30 WED.				

MICROWAVE CONCENTRATOR/BIOFILTER PROJECT
WEEKLY ANALOG DATA SUMMARY
Tyndall AFB (Project # 78204)
Data for week ending June 2, 2000

PARAMETER	TUES	WED.	FRI.	SAT.
Time of Day Measurements are Taken	4:40 PM	6:50PM	5:45PM	7:45PM
FE101-Differential Pressure ("WC)	2.2	2.2	2.2	2.2
TI101-Inlet Air Temperature (degrees C)	25	26	28	25
DPI 102- Pressure Across Biofilter ("WC)	0	0	0	0
PI 105- Pressure of Inlet Water (psi)	55	55	55	58
PI 103- Regulated Water Pressure (psi)	29	28	28	29
FQI 101- Flow Totalizer to T-102 (gallons)	5651	5669	5819	5842
FQI 102- Flow Totalizer to Humidifier T101 (gallons)	63980	63980	64026	64050
FQI 103- Flow Totalizer to Sprinklers (gallons)	14965	14997	15059	15090
FQI 104- Flow Totalizer to Weep Hoses (gallons)	9744	9760	9799	9804
PI 110- Inlet Pressure Before FQI 103 and 104 (psi)	0	0	0	0
TI 102- Temperature of Biofilter (degrees C)	26	28	30	30
PI104- Water Pressure before Pump 102 (psi)	0	0	0	0
PI102- Water Pressure after Pump 102 (psi)	0	0	0	0
Inlet Concentration to Carbon Tank (ppmv)				
Outlet Concentration of Carbon Tank (ppmv)				
Inlet Concentration to Biofilter (ppmv)	down	down	down	regenning
Outlet Concentration of Biofilter (ppmv)	down	down	down	

MICROWAVE CONCENTRATOR/BIOFILTER PROJECT
WEEKLY ANALOG DATA SUMMARY
Tyndall AFB (Project # 78204)
Data for week ending June 9, 2000

PARAMETER	MON. 5th	WED. 7th	THUR. 8th	COMMENTS
Time of Day Measurements are Taken	5:30PM	6:10PM	5:45PM	
FE101-Differential Pressure ("WC)	2.2	2.2	3+	turned blower off
TI101-Inlet Air Temperature (degrees C)	28	25	27	
DPI 102- Pressure Across Biofilter ("WC)	0	0	0	
PI 105- Pressure of Inlet Water (psi)	55	55	60	
PI 103- Regulated Water Pressure (psi)	26	27	27	
FQI 101- Flow Totalizer to T-102 (gallons)	5854	5864	5871	
FQI 102- Flow Totalizer to Humidifier T101 (gallons)	64095	64141	64165	
FQI 103- Flow Totalizer to Sprinklers (gallons)	15151	15214	15245	
FQI 104- Flow Totalizer to Weep Hoses (gallons)	9834	9864	9889	
PI 110- Inlet Pressure Before FQI 103 and 104 (psi)	0	0	0	
TI 102- Temperature of Biofilter (degrees C)	30	27	30	
PI104- Water Pressure before Pump 102 (psi)	0	0	0	
PI102- Water Pressure after Pump 102 (psi)	0	0	0	
Inlet Concentration to Carbon Tank (ppmv)				
Outlet Concentration of Carbon Tank (ppmv)				
Inlet Concentration to Biofilter (ppmv)				
Outlet Concentration of Biofilter (ppmv)				

MICROWAVE CONCENTRATOR/BIOFILTER PROJECT
WEEKLY ANALOG DATA SUMMARY
Tyndall AFB (Project # 78204)
Data for week ending June 16, 2000

PARAMETER	MON. 12	TUES. 13	WED. 14	THUR. 15
Time of Day Measurements are Taken	5:30 PM	5:30 PM	5:45 PM	6:15 PM
FE101-Differential Pressure ("WC)	2.5	2.5	2.5	2.5
TI101-Inlet Air Temperature (degrees C)	28	30	29	27
DPI 102- Pressure Across Biofilter ("WC)	0	0	0	0
PI 105- Pressure of Inlet Water (psi)	55	55	55	55
PI 103- Regulated Water Pressure (psi)	27	26	27	28
FQI 101- Flow Totalizer to T-102 (gallons)	5881	5885	5907	5915
FQI 102- Flow Totalizer to Humidifier T101 (gallons)	64190	64213	64237	64260
FQI 103- Flow Totalizer to Sprinklers (gallons)	15277	15309	15340	15371
FQI 104- Flow Totalizer to Weep Hoses (gallons)	9894	9919	9924	9939
PI 110- Inlet Pressure Before FQI 103 and 104 (psi)	0	0	0	0
TI 102- Temperature of Biofilter (degrees C)	31	31	32	32
PI104- Water Pressure before Pump 102 (psi)	0	0	0	0
PI102- Water Pressure after Pump 102 (psi)	0	0	0	0
Inlet Concentration to Carbon Tank (ppmv)				
Outlet Concentration of Carbon Tank (ppmv)				
Inlet Concentration to Biofilter (ppmv)				
Outlet Concentration of Biofilter (ppmv)				

MICROWAVE CONCENTRATOR/BIOFILTER PROJECT
WEEKLY ANALOG DATA SUMMARY
Tyndall AFB (Project # 78204)
Data for week ending:________________June 23, 2000___________________________________

PARAMETER		WED.	THUR.	FRI.
Time of Day Measurements are Taken		5:30PM	4:15PM	5:30PM
FE101-Differential Pressure ("WC)		2.5	2.5	2.5
TI101- Inlet Air Temperature (degrees C)		30	30	29
DPI 102- Pressure Across Biofilter ("WC)		0	0	0
PI 105- Pressure of Inlet Water (psi)		55	52	65 (!)
PI 103- Regulated Water Pressure (psi)		26	26	27
FQI 101- Flow Totalizer to T-102 (gallons)		5937	5942	5946
FQI 102- Flow Totalizer to Humidifier T101 (gallons)		64402	64428	64451
FQI 103- Flow Totalizer to Sprinklers (gallons)		15560	15591	15622
FQI 104- Flow Totalizer to Weep Hoses (gallons)		10027	10041	10055
PI 110- Inlet Pressure Before FQI 103 and 104 (psi)		0	0	0
TI 102- Temperature of Biofilter (degrees C)		32	32	31
PI104- Water Pressure before Pump 102 (psi)		0	0	0
PI102- Water Pressure after Pump 102 (psi)		0	0	0
Inlet Concentration to Carbon Tank (ppmv)				
Outlet Concentration from Carbon Tank (ppmv)				
Inlet Concentration to Biofilter (ppmv)				
Outlet Concentration of Biofilter (ppmv)				

MICROWAVE CONCENTRATOR/BIOFILTER PROJECT
WEEKLY ANALOG DATA SUMMARY
Tyndall AFB (Project # 78204)
Data for week ending:________________JUNE 30, 2000________________________________

PARAMETER	TUES.	WED.	THUR.	Comments	FRI.		SAT.
Time of Day Measurements are Taken	5:30PM	5:30PM	5:00PM		6:00 PM		12:40pm
FE101-Differential Pressure ("WC)	2.5	2.5	2.5		2.5		2.5
TI101- Inlet Air Temperature (degrees C)	28.5	30	27.5		29		31
DPI 102- Pressure Across Biofilter ("WC)	0	0	0		0		0
PI 105- Pressure of Inlet Water (psi)	55	60	65		65		65
PI 103- Regulated Water Pressure (psi)	28	27	28		27		26
FQI 101- Flow Totalizer to T-102 (gallons)	6033	6044	6059	Power out 8:00pm Thur	6059	*	6059
FQI 102- Flow Totalizer to Humidifier T101 (gallons)	64520	64544	64567	"	64567	*	64599
FQI 103- Flow Totalizer to Sprinklers (gallons)	15716	15747	15778	"	15778	*	15810
FQI 104- Flow Totalizer to Weep Hoses (gallons)	10109	10114	10129	"	10129	*	10144
PI 110- Inlet Pressure Before FQI 103 and 104 (psi)	0	0	0		0		0
TI 102- Temperature of Biofilter (degrees C)	32	31	30		31		32
PI104- Water Pressure before Pump 102 (psi)	0	0	0		0		0
PI102- Water Pressure after Pump 102 (psi)	0	0	0		0		0
Inlet Concentration to Carbon Tank (ppmv)							
Outlet Concentration from Carbon Tank (ppmv)							
Inlet Concentration to Biofilter (ppmv)	50	100	150		50		
Outlet Concentration of Biofilter (ppmv)							

MICROWAVE CONCENTRATOR/BIOFILTER PROJECT
WEEKLY ANALOG DATA SUMMARY
Tyndall AFB (Project # 78204)
Data for week ending:___________________July 7, 2000_______________________________

PARAMETER	MON.	WED.	FRI.	COMMENTS
Time of Day Measurements are Taken	1:00PM	5:30PM		
FE101-Differential Pressure ("WC)	2.5	2.5		
TI101- Inlet Air Temperature (degrees C)	31	28		
DPI 102- Pressure Across Biofilter ("WC)	0	0		
PI 105- Pressure of Inlet Water (psi)	65	65		
PI 103- Regulated Water Pressure (psi)	26	28		
FQI 101- Flow Totalizer to T-102 (gallons)	6059	6071		
FQI 102- Flow Totalizer to Humidifier T101 (gallons)	64632	64676		
FQI 103- Flow Totalizer to Sprinklers (gallons)	15872	15933		
FQI 104- Flow Totalizer to Weep Hoses (gallons)	10175	10205		
PI 110- Inlet Pressure Before FQI 103 and 104 (psi)	0	0		
TI 102- Temperature of Biofilter (degrees C)	30	31		
PI104- Water Pressure before Pump 102 (psi)	0	0		
PI102- Water Pressure after Pump 102 (psi)	0	0		
Inlet Concentration to Carbon Tank (ppmv)				
Outlet Concentration from Carbon Tank (ppmv)				
Inlet Concentration to Biofilter (ppmv)				
Outlet Concentration of Biofilter (ppmv)				

MICROWAVE CONCENTRATOR/BIOFILTER PROJECT
WEEKLY ANALOG DATA SUMMARY
Tyndall AFB (Project # 78204)
Data for week ending:________________July 14, 2000______________________________

PARAMETER	MON.	WED.	FRI.	COMMENTS
Time of Day Measurements are Taken	5:45PM	5:45PM	10:45AM	
FE101-Differential Pressure ("WC)	2.5	2.6	2.6	
TI101- Inlet Air Temperature (degrees C)	30	27	30	
DPI 102- Pressure Across Biofilter ("WC)	0	0	0	
PI 105- Pressure of Inlet Water (psi)	60	60	55	
PI 103- Regulated Water Pressure (psi)	28	29	28	
FQI 101- Flow Totalizer to T-102 (gallons)	6091	6109	6109	
FQI 102- Flow Totalizer to Humidifier T101 (gallons)	64784	64827	64873	
FQI 103- Flow Totalizer to Sprinklers (gallons)	16089	16150	16212	
FQI 104- Flow Totalizer to Weep Hoses (gallons)	10280	10310	10340	
PI 110- Inlet Pressure Before FQI 103 and 104 (psi)	0	0	0	
TI 102- Temperature of Biofilter (degrees C)	33	34	32	
PI104- Water Pressure before Pump 102 (psi)	0	0	0	
PI102- Water Pressure after Pump 102 (psi)	0	0	0	
Inlet Concentration to Carbon Tank (ppmv)				
Outlet Concentration from Carbon Tank (ppmv)				
Inlet Concentration to Biofilter (ppmv)				
Outlet Concentration of Biofilter (ppmv)				

MICROWAVE CONCENTRATOR/BIOFILTER PROJECT
WEEKLY ANALOG DATA SUMMARY
Tyndall AFB (Project # 78204)
Data for week ending: July 21, 2000

PARAMETER	MON.	WED.	FRI.	COMMENTS
Time of Day Measurements are Taken	2:00PM	6:00PM	1:00PM	
FE101-Differential Pressure ("WC)	2.5	2.5	2.5	
TI101- Inlet Air Temperature (degrees C)	31	31	30	
DPI 102- Pressure Across Biofilter ("WC)	0	0	0	
PI 105- Pressure of Inlet Water (psi)	60	55	60	
PI 103- Regulated Water Pressure (psi)	27	28	27	
FQI 101- Flow Totalizer to T-102 (gallons)	6121	6136	6155	
FQI 102- Flow Totalizer to Humidifier T101 (gallons)	64966	65033	65092	
FQI 103- Flow Totalizer to Sprinklers (gallons)	16305	16366	16427	
FQI 104- Flow Totalizer to Weep Hoses (gallons)	10385	10415	10445	
PI 110- Inlet Pressure Before FQI 103 and 104 (psi)	0	0	0	
TI 102- Temperature of Biofilter (degrees C)	32	35	32	
PI104- Water Pressure before Pump 102 (psi)	0	0	0	
PI102- Water Pressure after Pump 102 (psi)	0	0	0	
Inlet Concentration to Carbon Tank (ppmv)				
Outlet Concentration from Carbon Tank (ppmv)				
Inlet Concentration to Biofilter (ppmv)	150	135	165	
Outlet Concentration of Biofilter (ppmv)				

MICROWAVE CONCENTRATOR/BIOFILTER PROJECT
WEEKLY ANALOG DATA SUMMARY
Tyndall AFB (Project # 78204)
Data for week ending:_________________July 28, 2000_________________

PARAMETER	MON.	WED.	FRI.	COMMENTS
Time of Day Measurements are Taken	5:30PM	6:10PM	3:30PM	
FE101-Differential Pressure ("WC)	2.5	2.6	2.6	
TI101- Inlet Air Temperature (degrees C)	30	30	30	
DPI 102- Pressure Across Biofilter ("WC)	0	0	0	
PI 105- Pressure of Inlet Water (psi)	65	55	65	
PI 103- Regulated Water Pressure (psi)	28	27	27	
FQI 101- Flow Totalizer to T-102 (gallons)	6165	6165	6180	
FQI 102- Flow Totalizer to Humidifier T101 (gallons)	65132	65201	65270	
FQI 103- Flow Totalizer to Sprinklers (gallons)	16458	16519	16577	
FQI 104- Flow Totalizer to Weep Hoses (gallons)	10461	10491	10521	
PI 110- Inlet Pressure Before FQI 103 and 104 (psi)	0	0	0	
TI 102- Temperature of Biofilter (degrees C)	34	34	33	
PI104- Water Pressure before Pump 102 (psi)	0	0	0	
PI102- Water Pressure after Pump 102 (psi)	0	0	0	
Inlet Concentration to Carbon Tank (ppmv)				
Outlet Concentration from Carbon Tank (ppmv)				
Inlet Concentration to Biofilter (ppmv)				
Outlet Concentration of Biofilter (ppmv)				

MICROWAVE CONCENTRATOR/BIOFILTER PROJECT
WEEKLY ANALOG DATA SUMMARY
Tyndall AFB (Project # 78204)
Data for week ending:_____________Aug. 4, 2000

PARAMETER	MON.	WED.	FRI.	COMMENTS
Time of Day Measurements are Taken	1:00PM			
FE101-Differential Pressure ("WC)	2.6			
TI101- Inlet Air Temperature (degrees C)	30			
DPI 102- Pressure Across Biofilter ("WC)	0			
PI 105- Pressure of Inlet Water (psi)	65			
PI 103- Regulated Water Pressure (psi)	28			
FQI 101- Flow Totalizer to T-102 (gallons)	6200			
FQI 102- Flow Totalizer to Humidifier T101 (gallons)	65374			
FQI 103- Flow Totalizer to Sprinklers (gallons)	16664			
FQI 104- Flow Totalizer to Weep Hoses (gallons)	10567			
PI 110- Inlet Pressure Before FQI 103 and 104 (psi)	0			
TI 102- Temperature of Biofilter (degrees C)	30			
PI104- Water Pressure before Pump 102 (psi)	0			
PI102- Water Pressure after Pump 102 (psi)	0			
Inlet Concentration to Carbon Tank (ppmv)				
Outlet Concentration from Carbon Tank (ppmv)				
Inlet Concentration to Biofilter (ppmv)	248			
Outlet Concentration of Biofilter (ppmv)	3.4			

MICROWAVE CONCENTRATOR/BIOFILTER PROJECT
WEEKLY ANALOG DATA SUMMARY
Tyndall AFB (Project # 78204)
Data for week ending:___________AUG 11, 2000

PARAMETER	MON.	WED.	FRI.	COMMENTS
Time of Day Measurements are Taken	4:00PM	6:00PM	5:00PM	
FE101-Differential Pressure ("WC)	2.6	2.6	2.5	
TI101- Inlet Air Temperature (degrees C)	30	29	29.5	
DPI 102- Pressure Across Biofilter ("WC)	0	0	0	
PI 105- Pressure of Inlet Water (psi)	70	55	65	
PI 103- Regulated Water Pressure (psi)	27	29	28	
FQI 101- Flow Totalizer to T-102 (gallons)	6201	6227	6239	
FQI 102- Flow Totalizer to Humidifier T101 (gallons)	65607	65680	65750	
FQI 103- Flow Totalizer to Sprinklers (gallons)	16862	16918	16968	
FQI 104- Flow Totalizer to Weep Hoses (gallons)	10654	10680	10706	
PI 110- Inlet Pressure Before FQI 103 and 104 (psi)	0	0	0	
TI 102- Temperature of Biofilter (degrees C)	32	35	32	
PI104- Water Pressure before Pump 102 (psi)	0	0	0	
PI102- Water Pressure after Pump 102 (psi)	0	0	0	
Inlet Concentration to Carbon Tank (ppmv)				
Outlet Concentration from Carbon Tank (ppmv)				
Inlet Concentration to Biofilter (ppmv)				
Outlet Concentration of Biofilter (ppmv)				

MICROWAVE CONCENTRATOR/BIOFILTER PROJECT
WEEKLY ANALOG DATA SUMMARY
Tyndall AFB (Project # 78204)
Data for week ending:_________________Aug 18, 2000______________________________

PARAMETER	MON.	WED.	FRI.	COMMENTS
Time of Day Measurements are Taken	5:00PM			
FE101-Differential Pressure ("WC)	2.5			
TI101- Inlet Air Temperature (degrees C)	30			
DPI 102- Pressure Across Biofilter ("WC)	0			
PI 105- Pressure of Inlet Water (psi)	70			
PI 103- Regulated Water Pressure (psi)	27			
FQI 101- Flow Totalizer to T-102 (gallons)	6230			
FQI 102- Flow Totalizer to Humidifier T101 (gallons)	65862			
FQI 103- Flow Totalizer to Sprinklers (gallons)	17030			
FQI 104- Flow Totalizer to Weep Hoses (gallons)	10753			
PI 110- Inlet Pressure Before FQI 103 and 104 (psi)	0			
TI 102- Temperature of Biofilter (degrees C)	32			
PI104- Water Pressure before Pump 102 (psi)	0			
PI102- Water Pressure after Pump 102 (psi)	0			
Inlet Concentration to Carbon Tank (ppmv)				
Outlet Concentration from Carbon Tank (ppmv)				
Inlet Concentration to Biofilter (ppmv)				
Outlet Concentration of Biofilter (ppmv)				

MICROWAVE CONCENTRATOR/BIOFILTER PROJECT
WEEKLY ANALOG DATA SUMMARY
Tyndall AFB (Project # 78204)
Data for week ending:______________ Aug 25, 2000_______________________________________

PARAMETER	MON.	WED.	FRI.	COMMENTS
Time of Day Measurements are Taken	6:00PM	6:00PM	6:00PM	
FE101-Differential Pressure ("WC)	2.5	2.5	2.3	
TI101- Inlet Air Temperature (degrees C)	27	26	29	
DPI 102- Pressure Across Biofilter ("WC)	0	0	0	
PI 105- Pressure of Inlet Water (psi)	65	65	60	
PI 103- Regulated Water Pressure (psi)	30	30	29	
FQI 101- Flow Totalizer to T-102 (gallons)	6243	6245	6245	
FQI 102- Flow Totalizer to Humidifier T101 (gallons)	66120	66190	66260	
FQI 103- Flow Totalizer to Sprinklers (gallons)	17136	17166	17184	
FQI 104- Flow Totalizer to Weep Hoses (gallons)	10855	10883	10916	
PI 110- Inlet Pressure Before FQI 103 and 104 (psi)	0	0	0	
TI 102- Temperature of Biofilter (degrees C)	31	31	33	
PI104- Water Pressure before Pump 102 (psi)	0	0	0	
PI102- Water Pressure after Pump 102 (psi)	0	0	0	
Inlet Concentration to Carbon Tank (ppmv)				
Outlet Concentration from Carbon Tank (ppmv)				
Inlet Concentration to Biofilter (ppmv)				
Outlet Concentration of Biofilter (ppmv)				

MICROWAVE CONCENTRATOR/BIOFILTER PROJECT
WEEKLY ANALOG DATA SUMMARY
Tyndall AFB (Project # 78204)
Data for week ending:_____________September 1, 2000_____________

PARAMETER	MON.	WED.	FRI.	COMMENTS
Time of Day Measurements are Taken	7:00PM	6:00PM	6:00PM	
FE101-Differential Pressure ("WC)	2.2	2.2	2.1	*****
TI101- Inlet Air Temperature (degrees C)	29	30	28	
DPI 102- Pressure Across Biofilter ("WC)	0	0	0	
PI 105- Pressure of Inlet Water (psi)	55	55	55	
PI 103- Regulated Water Pressure (psi)	30	28	29	
FQI 101- Flow Totalizer to T-102 (gallons)	6244	6244	6259	
FQI 102- Flow Totalizer to Humidifier T101 (gallons)	66368	66442	66516	
FQI 103- Flow Totalizer to Sprinklers (gallons)	17208	17225	17247	changed to 5,6,0,17
FQI 104- Flow Totalizer to Weep Hoses (gallons)	10954	10977	11002	
PI 110- Inlet Pressure Before FQI 103 and 104 (psi)	0	0	0	
TI 102- Temperature of Biofilter (degrees C)	33	32	33	
PI104- Water Pressure before Pump 102 (psi)	0	0	0	
PI102- Water Pressure after Pump 102 (psi)	0	0	0	
Inlet Concentration to Carbon Tank (ppmv)				
Outlet Concentration from Carbon Tank (ppmv)				
Inlet Concentration to Biofilter (ppmv)				
Outlet Concentration of Biofilter (ppmv)				

MICROWAVE CONCENTRATOR/BIOFILTER PROJECT
WEEKLY ANALOG DATA SUMMARY
Tyndall AFB (Project # 78204)
Data for week ending:_____________September 8, 2000_____________

PARAMETER	TUES	WED.	FRI.	COMMENTS
Time of Day Measurements are Taken	3:30PM	3:30PM	6:00PM	
FE101-Differential Pressure ("WC)	2	2	1.9	decreasing
TI101- Inlet Air Temperature (degrees C)	30	29	29	
DPI 102- Pressure Across Biofilter ("WC)	0	0	0	
PI 105- Pressure of Inlet Water (psi)	75	75	60	
PI 103- Regulated Water Pressure (psi)	28	28	28	
FQI 101- Flow Totalizer to T-102 (gallons)	6270	6271	6271	only 1 gal for the week
FQI 102- Flow Totalizer to Humidifier T101 (gallons)	66650	66682	66740	
FQI 103- Flow Totalizer to Sprinklers (gallons)	17310	17327	17356	
FQI 104- Flow Totalizer to Weep Hoses (gallons)	11051	11064	11091	
PI 110- Inlet Pressure Before FQI 103 and 104 (psi)	0	0	0	
TI 102- Temperature of Biofilter (degrees C)	30	30	30	
PI104- Water Pressure before Pump 102 (psi)	0	0	0	
PI102- Water Pressure after Pump 102 (psi)	0	0	0	
Inlet Concentration to Carbon Tank (ppmv)				
Outlet Concentration from Carbon Tank (ppmv)				
Inlet Concentration to Biofilter (ppmv)	190	240		
Outlet Concentration of Biofilter (ppmv)	4	3.1		

MICROWAVE CONCENTRATOR/BIOFILTER PROJECT
WEEKLY ANALOG DATA SUMMARY
Tyndall AFB (Project # 78204)
Data for week ending:______________Sep 15, 2000______________________________________

PARAMETER	MON.	WED.	FRI.	COMMENTS
Time of Day Measurements are Taken	6:00PM	4:45PM	11:00AM	
FE101-Differential Pressure ("WC)	2.2	2	2	adjusted 1 notch on Wed. & Fri
TI101- Inlet Air Temperature (degrees C)	28	30	30	
DPI 102- Pressure Across Biofilter ("WC)	0	0	0	
PI 105- Pressure of Inlet Water (psi)	70	70	70	
PI 103- Regulated Water Pressure (psi)	29	27	27	
FQI 101- Flow Totalizer to T-102 (gallons)	6281	6293	6301	
FQI 102- Flow Totalizer to Humidifier T101 (gallons)	66835	66902	66966	
FQI 103- Flow Totalizer to Sprinklers (gallons)	17424	17472	17517	
FQI 104- Flow Totalizer to Weep Hoses (gallons)	11151	11180	11214	
PI 110- Inlet Pressure Before FQI 103 and 104 (psi)	0	0	0	
TI 102- Temperature of Biofilter (degrees C)	30	32	32	
PI104- Water Pressure before Pump 102 (psi)	0	0	0	
PI102- Water Pressure after Pump 102 (psi)	0	0	0	
Inlet Concentration to Carbon Tank (ppmv)				
Outlet Concentration from Carbon Tank (ppmv)				
Inlet Concentration to Biofilter (ppmv)		200		
Outlet Concentration of Biofilter (ppmv)		4		

MICROWAVE CONCENTRATOR/BIOFILTER PROJECT
WEEKLY ANALOG DATA SUMMARY
Tyndall AFB (Project # 78204)
Data for week ending:______________Sep 22, 2000_______________________________________

PARAMETER	MON.	WED.	FRI.	COMMENTS
Time of Day Measurements are Taken	5:00PM	5:00PM	4:30PM	
FE101-Differential Pressure ("WC)	1.7	1.6	1.7	
TI101- Inlet Air Temperature (degrees C)	28	30	29	
DPI 102- Pressure Across Biofilter ("WC)	0	0	0	
PI 105- Pressure of Inlet Water (psi)	70	65	70	
PI 103- Regulated Water Pressure (psi)	29	29	30	
FQI 101- Flow Totalizer to T-102 (gallons)	6318	6332	6334	
FQI 102- Flow Totalizer to Humidifier T101 (gallons)	67065	67132	67188	
FQI 103- Flow Totalizer to Sprinklers (gallons)	17581	17628	17651	changed to 2, 3, 0, 17, on FRI
FQI 104- Flow Totalizer to Weep Hoses (gallons)	11269	11314	11335	
PI 110- Inlet Pressure Before FQI 103 and 104 (psi)	0	0	0	
TI 102- Temperature of Biofilter (degrees C)	28	30	30	
PI104- Water Pressure before Pump 102 (psi)	0	0	0	
PI102- Water Pressure after Pump 102 (psi)	0	0	0	
Inlet Concentration to Carbon Tank (ppmv)				
Outlet Concentration from Carbon Tank (ppmv)				
Inlet Concentration to Biofilter (ppmv)		250	260	
Outlet Concentration of Biofilter (ppmv)		21	3	

MICROWAVE CONCENTRATOR/BIOFILTER PROJECT
WEEKLY ANALOG DATA SUMMARY
Tyndall AFB (Project # 78204)
Data for week ending:____September 29, 2000____

PARAMETER	MON.	WED.	FRI.	COMMENTS
Time of Day Measurements are Taken	12:00 PM	4:00PM	4:00PM	
FE101-Differential Pressure ("WC)	1.6	1.5	2.8	BLOWER SCREEN
TI101- Inlet Air Temperature (degrees C)	32	27	26	
DPI 102- Pressure Across Biofilter ("WC)	0	0	0	
PI 105- Pressure of Inlet Water (psi)	70	70	65	
PI 103- Regulated Water Pressure (psi)	27	28	27	
FQI 101- Flow Totalizer to T-102 (gallons)	6334	6334	6337	drained union 15 gal WED
FQI 102- Flow Totalizer to Humidifier T101 (gallons)	67262	67330	67398	
FQI 103- Flow Totalizer to Sprinklers (gallons)	17688	17712	17736	
FQI 104- Flow Totalizer to Weep Hoses (gallons)	11366	11387	11401	
PI 110- Inlet Pressure Before FQI 103 and 104 (psi)	0	0	0	
TI 102- Temperature of Biofilter (degrees C)	32	25	25	
PI104- Water Pressure before Pump 102 (psi)	0	0	0	
PI102- Water Pressure after Pump 102 (psi)	0	0	0	
Inlet Concentration to Carbon Tank (ppmv)				
Outlet Concentration from Carbon Tank (ppmv)				
Inlet Concentration to Biofilter (ppmv)	190			
Outlet Concentration of Biofilter (ppmv)	5			

MICROWAVE CONCENTRATOR/BIOFILTER PROJECT
WEEKLY ANALOG DATA SUMMARY
Tyndall AFB (Project # 78204)
Data for week ending:___________ OCT 6, 2000

PARAMETER	MON.	WED.	FRI.	COMMENTS
Time of Day Measurements are Taken	4:320PM	4:30PM	4:30PM	
FE101-Differential Pressure ("WC)	2.8	2.9	2.9	
TI101- Inlet Air Temperature (degrees C)	26	29	22	
DPI 102- Pressure Across Biofilter ("WC)	0.1	0.1	0	
PI 105- Pressure of Inlet Water (psi)	70	65	70	
PI 103- Regulated Water Pressure (psi)	26	26	31	
FQI 101- Flow Totalizer to T-102 (gallons)	6342	6344	6344	
FQI 102- Flow Totalizer to Humidifier T101 (gallons)	67516	67596	67675	
FQI 103- Flow Totalizer to Sprinklers (gallons)	17771	17795	17818	
FQI 104- Flow Totalizer to Weep Hoses (gallons)	11420	11432	11445	
PI 110- Inlet Pressure Before FQI 103 and 104 (psi)	0	0	0	
TI 102- Temperature of Biofilter (degrees C)	25	27	32	
PI104- Water Pressure before Pump 102 (psi)	0	0	0	
PI102- Water Pressure after Pump 102 (psi)	0	0	0	
Inlet Concentration to Carbon Tank (ppmv)				
Outlet Concentration from Carbon Tank (ppmv)				
Inlet Concentration to Biofilter (ppmv)	52		740	
Outlet Concentration of Biofilter (ppmv)	10.8		80	

MICROWAVE CONCENTRATOR/BIOFILTER PROJECT
WEEKLY ANALOG DATA SUMMARY
Tyndall AFB (Project # 78204)
Data for week ending:_______________OCT 13, 2000_______________

PARAMETER	MON.	WED.	FRI.	COMMENTS
Time of Day Measurements are Taken	4:30PM		2:00PM	
FE101-Differential Pressure ("WC)	3		2.9	
TI101- Inlet Air Temperature (degrees C)	16		25	
DPI 102- Pressure Across Biofilter ("WC)	0		0	
PI 105- Pressure of Inlet Water (psi)	70		65	
PI 103- Regulated Water Pressure (psi)	30		27	
FQI 101- Flow Totalizer to T-102 (gallons)	6352		6373	
FQI 102- Flow Totalizer to Humidifier T101 (gallons)	67788		67938	
FQI 103- Flow Totalizer to Sprinklers (gallons)	17853		17900	
FQI 104- Flow Totalizer to Weep Hoses (gallons)	11464		11488	
PI 110- Inlet Pressure Before FQI 103 and 104 (psi)	0		0	
TI 102- Temperature of Biofilter (degrees C)	16		22	
PI104- Water Pressure before Pump 102 (psi)	0		0	
PI102- Water Pressure after Pump 102 (psi)	0		0	
Inlet Concentration to Carbon Tank (ppmv)				
Outlet Concentration from Carbon Tank (ppmv)				
Inlet Concentration to Biofilter (ppmv)				
Outlet Concentration of Biofilter (ppmv)				

MICROWAVE CONCENTRATOR/BIOFILTER PROJECT
WEEKLY ANALOG DATA SUMMARY
Tyndall AFB (Project # 78204)
Data for week ending:__________________OCT 20, 2000__________________________________

PARAMETER	MON.	THUR.	FRI.	COMMENTS
Time of Day Measurements are Taken	3:25PM	3:25PM	2:00PM	
FE101-Differential Pressure ("WC)	2.85	2.85	2.9	
TI101- Inlet Air Temperature (degrees C)	24	25	28	
DPI 102- Pressure Across Biofilter ("WC)	0	0	0	
PI 105- Pressure of Inlet Water (psi)	75	55	60	
PI 103- Regulated Water Pressure (psi)	30	27	28	
FQI 101- Flow Totalizer to T-102 (gallons)	6373	6373	6373	
FQI 102- Flow Totalizer to Humidifier T101 (gallons)	87976	68088	68122	
FQI 103- Flow Totalizer to Sprinklers (gallons)	17913	17948	17960	
FQI 104- Flow Totalizer to Weep Hoses (gallons)	11493	11512	11528	
PI 110- Inlet Pressure Before FQI 103 and 104 (psi)	0	0	0	
TI 102- Temperature of Biofilter (degrees C)	25	27	29	
PI104- Water Pressure before Pump 102 (psi)	0	0	0	
PI102- Water Pressure after Pump 102 (psi)	0	0	0	
Inlet Concentration to Carbon Tank (ppmv)				
Outlet Concentration from Carbon Tank (ppmv)				
Inlet Concentration to Biofilter (ppmv)	1250			
Outlet Concentration of Biofilter (ppmv)	65			

MICROWAVE CONCENTRATOR/BIOFILTER PROJECT
WEEKLY ANALOG DATA SUMMARY
Tyndall AFB (Project # 78204)
Data for week ending:______________OCT 27, 2000______________________________________

PARAMETER	MON.	WED.	FRI.	COMMENTS
Time of Day Measurements are Taken	4:30PM	3:30PM	7:45PM	
FE101-Differential Pressure ("WC)	2.9	2.85	2.9	
TI101- Inlet Air Temperature (degrees C)	24	26	22	
DPI 102- Pressure Across Biofilter ("WC)	0	0	0	
PI 105- Pressure of Inlet Water (psi)	60	55	60	
PI 103- Regulated Water Pressure (psi)	27	27	30	
FQI 101- Flow Totalizer to T-102 (gallons)	6380	6390	6405	
FQI 102- Flow Totalizer to Humidifier T101 (gallons)	68238	68315	68395	
FQI 103- Flow Totalizer to Sprinklers (gallons)	17997	18020	18044	
FQI 104- Flow Totalizer to Weep Hoses (gallons)	11537	11548	11560	
PI 110- Inlet Pressure Before FQI 103 and 104 (psi)	0	0	0	
TI 102- Temperature of Biofilter (degrees C)	27	24	24	
PI104- Water Pressure before Pump 102 (psi)	0	0	0	
PI102- Water Pressure after Pump 102 (psi)	0	0	0	
Inlet Concentration to Carbon Tank (ppmv)				
Outlet Concentration from Carbon Tank (ppmv)				
Inlet Concentration to Biofilter (ppmv)	1400			
Outlet Concentration of Biofilter (ppmv)				

MICROWAVE CONCENTRATOR/BIOFILTER PROJECT
WEEKLY ANALOG DATA SUMMARY
Tyndall AFB (Project # 78204)
Data for week ending:________________NOV 3, 2000

PARAMETER	MON.	WED.	FRI.	COMMENTS
Time of Day Measurements are Taken	2:00PM	5:15PM		
FE101-Differential Pressure ("WC)	2.9	2.9		
TI101- Inlet Air Temperature (degrees C)	26	24		
DPI 102- Pressure Across Biofilter ("WC)	0	0		
PI 105- Pressure of Inlet Water (psi)	70	60		
PI 103- Regulated Water Pressure (psi)	27	30		
FQI 101- Flow Totalizer to T-102 (gallons)	6423	6434		
FQI 102- Flow Totalizer to Humidifier T101 (gallons)	68502	68579		
FQI 103- Flow Totalizer to Sprinklers (gallons)	18081	18106		
FQI 104- Flow Totalizer to Weep Hoses (gallons)	11580	11591		
PI 110- Inlet Pressure Before FQI 103 and 104 (psi)	0	0		
TI 102- Temperature of Biofilter (degrees C)	26	26		
PI104- Water Pressure before Pump 102 (psi)	0	0		
PI102- Water Pressure after Pump 102 (psi)	0	0		
Inlet Concentration to Carbon Tank (ppmv)				
Outlet Concentration from Carbon Tank (ppmv)				
Inlet Concentration to Biofilter (ppmv)	1500	2000		
Outlet Concentration of Biofilter (ppmv)	113	80		

MICROWAVE CONCENTRATOR/BIOFILTER PROJECT
WEEKLY ANALOG DATA SUMMARY
Tyndall AFB (Project # 78204)
Data for week ending:____________Nov 10, 2000____

PARAMETER	MON.	WED.	FRI.	COMMENTS
Time of Day Measurements are Taken	2:00 PM	5:00PM		
FE101-Differential Pressure ("WC)	2.9	2.9		
TI101- Inlet Air Temperature (degrees C)	25	24		
DPI 102- Pressure Across Biofilter ("WC)	0	0		
PI 105- Pressure of Inlet Water (psi)	90	60		
PI 103- Regulated Water Pressure (psi)	29	29		
FQI 101- Flow Totalizer to T-102 (gallons)	6466	6477		
FQI 102- Flow Totalizer to Humidifier T101 (gallons)	68761	68831		
FQI 103- Flow Totalizer to Sprinklers (gallons)	18167	18192		
FQI 104- Flow Totalizer to Weep Hoses (gallons)	11633	11645		
PI 110- Inlet Pressure Before FQI 103 and 104 (psi)	0	0		
TI 102- Temperature of Biofilter (degrees C)	25	28		
PI104- Water Pressure before Pump 102 (psi)	0	0		
PI102- Water Pressure after Pump 102 (psi)	0	0		
Inlet Concentration to Carbon Tank (ppmv)				
Outlet Concentration from Carbon Tank (ppmv)				
Inlet Concentration to Biofilter (ppmv)	1600			
Outlet Concentration of Biofilter (ppmv)				

MICROWAVE CONCENTRATOR/BIOFILTER PROJECT
WEEKLY ANALOG DATA SUMMARY
Tyndall AFB (Project # 78204)
Data for week ending:____________Nov 17, 2000____

PARAMETER	MON.	WED.	FRI.	COMMENTS
Time of Day Measurements are Taken	4:00PM	3:00PM		
FE101-Differential Pressure ("WC)	3	3		
TI101- Inlet Air Temperature (degrees C)	22	18.5		
DPI 102- Pressure Across Biofilter ("WC)	0	0		
PI 105- Pressure of Inlet Water (psi)	65	55		
PI 103- Regulated Water Pressure (psi)	29	30		
FQI 101- Flow Totalizer to T-102 (gallons)	6486	6486		
FQI 102- Flow Totalizer to Humidifier T101 (gallons)	68986	69048		
FQI 103- Flow Totalizer to Sprinklers (gallons)	18254	18278		
FQI 104- Flow Totalizer to Weep Hoses (gallons)	11674	11686		
PI 110- Inlet Pressure Before FQI 103 and 104 (psi)	0	0		
TI 102- Temperature of Biofilter (degrees C)	22	17		
PI104- Water Pressure before Pump 102 (psi)	0	0		
PI102- Water Pressure after Pump 102 (psi)	0	0		
Inlet Concentration to Carbon Tank (ppmv)				
Outlet Concentration from Carbon Tank (ppmv)				
Inlet Concentration to Biofilter (ppmv)				
Outlet Concentration of Biofilter (ppmv)				

MICROWAVE CONCENTRATOR/BIOFILTER PROJECT
WEEKLY ANALOG DATA SUMMARY
Tyndall AFB (Project # 78204)
Data for week ending:___________Nov 24, 2000_______________________________________

PARAMETER	MON.	TUES.	FRI.	COMMENTS
Time of Day Measurements are Taken	5:00PM	3:00PM		
FE101-Differential Pressure ("WC)	3.1	3.1		
TI101- Inlet Air Temperature (degrees C)	13	15		
DPI 102- Pressure Across Biofilter ("WC)	0	0		
PI 105- Pressure of Inlet Water (psi)	70	0		off on Tues
PI 103- Regulated Water Pressure (psi)	28	0		off on Tues
FQI 101- Flow Totalizer to T-102 (gallons)	6490	6490		
FQI 102- Flow Totalizer to Humidifier T101 (gallons)	69194	69223		
FQI 103- Flow Totalizer to Sprinklers (gallons)	18346	18370		manual on Tues
FQI 104- Flow Totalizer to Weep Hoses (gallons)	11714	11730		manual on Tues
PI 110- Inlet Pressure Before FQI 103 and 104 (psi)	0	0		
TI 102- Temperature of Biofilter (degrees C)	14	16		
PI104- Water Pressure before Pump 102 (psi)	0	0		off on Tues
PI102- Water Pressure after Pump 102 (psi)	0	0		
Inlet Concentration to Carbon Tank (ppmv)				
Outlet Concentration from Carbon Tank (ppmv)				
Inlet Concentration to Biofilter (ppmv)				
Outlet Concentration of Biofilter (ppmv)				

Date	Problem and Resolution	To Repair	Down
4/7/2000	Adjusted “orange monitor” (reactor hopper level sensor).	0.5	0.5
4/17/2000	Solid state relay for compressors shorted “on”. Replaced.	2	2
4/20/2000	Replaced 50 amp fuse.	0.5	0.5
4/26/2000	Replaced 50 amp fuse.	0.5	0.5
4/27/2000	Replaced all (3) 50 amp fuses with 60 amp fuses.	0.5	0.5
5/10/2000	Carbon transfer failed. Carbon remained stationary. “Glowing glob” of carbon created (potential fire). Quartz tube #1 cracked. Spares were wrong size so tube was reinstalled upside down so crack was inside “tophat”.	8	16
5/18/2000	Regeneration temperature sensor erratic due to interference by microwaves. Attempted to troubleshoot but the probe was still erratic.	2	
5/23/2000	Gould valve stuck open. Removed and replaced with manual valve. Replaced air filters in the knockout tanks.	2	2
5/26/2000	“Orange monitor” failed. Indicated high when column was empty. “Glowing glob” of carbon created (potential fire).	3	3
5/29/2000	Inspection found quartz tube #4 cracked.	1	8
5/30/2000	Received correct size spare. Replace quartz tube #4.	8	8
5/31/2000	Carbon "bridge"(clog) formed in reactor column. Required removal of top hopper.	8	8
6/2/2000	Changed input of “orange monitor” (reactor hopper level sensor) from CH0 to CH1.	0.5	0.5
6/3/2000	Removed and adjusted “orange monitor” in carbon.	1	1
6/5/2000	“Glowing glob” of carbon created (potential fire). Replaced H_2O plastic line.	1	1
6/7/2000	Replaced N_2 plastic line. Replaced H_2O plastic line.	1	1
6/9/2000	Shipped Thermo analyzer out for another job.		
6/10/2000	Replaced 1 fan belt on 100 cfm blower.	1	1
6/12/2000	Replaced other fan belt on blower. Water pump stopped twice due to overheating and thermal protection.	1	1
6/14/2000	Carbon transfer sequence failed. Blower did not run due to blower contactor failure	2	8
6/16-19/00	Charlie Carlisle visits to make repairs.		
6/21/2000	Water pump continues to overheat but system shuts down due to software enhancements.		
6/29/2000	Eagle analyzer will zero but not span properly. Another analyzer was sent to replace.	2	
7/3/2000	Adjusted “orange monitor” (reactor hopper level sensor).	0.5	0.5
7/4/2000	Attempted to repair other Eagle analyzer. The pump is bad.	6	
7/10/2000	Flow gauge inop. Repaired.	1	1
7/20/2000	Installed safety check for regeneration column temperature overheating.	1	1
7/24/2000	Flow gauge inop. Repaired.	1	1
7/26/2000	Flow gauge inop. Repaired. Possibly a bad channel.	1	1
8/4/2000	Quartz Tubes #3 & #4 cracked. Removed tubes.	4	4
8/7/2000	Replaced quartz tubes.	8	8

Date	Problem and Resolution	Hours To Repair	Time Down
8/8/2000	Replaced “orange monitor” with spare.	2	2
8/14/2000	Repaired Thermo Analyzer Pump.	2	
8/15/2000	Software glitch- reboot.		
8/17/2000	Transformer for magnetron #2 shorted.	0	5
8/18/2000	Replaced transformer	2	2
8/24/2000	Transformer (#2) shorted again. Replaced transformer, capacitor, and magnetron #2.	3	3
8/25/2000	Replaced magnetron #1. Did not have a spare diode.	1	8
8/30/2000	Installed diode.	1	16
9/1/2000	Carbon “bridge” (clog) in adsorber hopper	2	8
9/2/2000	Removed and replaced adsorber hopper in order to dislodge carbon “bridge”.	4	8

APPENDIX C

MASS BALANCE CALCULATIONS

REMOVAL OF CONTAMINANT ACROSS THE BIOFILTER

Date/Time	In (ppm)	Out (ppm)	In Corr.	Out Corr.	Inlet (mg/m3)	Outlet (mg/m3)	Inlet Load (mg/min)	Outlet Load (mg/min)	Mass In (mg)	Mass Out (mg)
9/19/2000 20:00	155.416	3.41298	159.316	0	78.383472	0	201.52	0.00	2216.63	248.14
9/19/2000 20:10	187.258	45.233	191.158	39.233	94.049736	19.302636	241.80	49.63	2390.25	510.35
9/19/2000 20:20	182.868	47.4598	186.768	41.4598	91.889856	20.3982216	236.25	52.44	2221.51	504.80
9/19/2000 20:30	160.577	44.3554	164.477	38.3554	80.922684	18.8708568	208.05	48.52	2049.28	598.97
9/19/2000 20:40	155.638	62.3479	159.538	56.3479	78.492696	27.7231668	201.80	71.28	2996.39	814.38
9/19/2000 20:50	310.325	78.4144	314.225	72.4144	154.5987	35.6278848	397.47	91.60	3445.92	966.67
9/19/2000 21:00	226.713	86.4273	230.613	80.4273	113.461596	39.5702316	291.71	101.74	2883.99	568.95
9/19/2000 21:10	221.478	15.5299	225.378	9.5299	110.885976	4.6887108	285.09	12.05	2871.69	460.55
9/19/2000 21:20	224.768	69.2881	228.668	63.2881	112.504656	31.1377452	289.25	80.06	2852.07	800.71
9/19/2000 21:30	218.377	69.3125	222.277	63.3125	109.360284	31.14975	281.17	80.09	4800.77	400.43
9/19/2000 21:40	532.879	1.27566	536.779	0	264.095268	0	678.99	0.00	4163.25	25.89
9/19/2000 21:50	117.577	10.0931	121.477	4.0931	59.766684	2.0138052	153.66	5.18	2244.86	280.40
9/19/2000 22:00	229.56	46.2407	233.46	40.2407	114.86232	19.7984244	295.31	50.90	2909.31	560.47
9/19/2000 22:10	222.635	54.3756	226.535	48.3756	111.45522	23.8007952	286.55	61.19	2832.51	605.03
9/19/2000 22:20	217.417	53.2866	221.317	47.2866	108.887964	23.2650072	279.95	59.81	2766.82	604.41
9/19/2000 22:30	212.248	54.2781	216.148	48.2781	106.344816	23.7528252	273.41	61.07	2710.26	618.70
9/19/2000 22:40	208.474	55.5458	212.374	49.5458	104.488008	24.3765336	268.64	62.67	2645.71	626.41
9/19/2000 22:50	202.042	55.4971	205.942	49.4971	101.323464	24.3525732	260.50	62.61	2541.20	618.65
9/19/2000 23:00	191.951	54.3187	195.851	48.3187	96.358692	23.7728004	247.74	61.12	2459.53	611.51
9/19/2000 23:10	189.128	54.3675	193.028	48.3675	94.969776	23.79681	244.17	61.18	2436.18	611.46
9/19/2000 23:20	188.259	54.3106	192.159	48.3106	94.542228	23.7688152	243.07	61.11	2466.17	618.45
9/19/2000 23:30	193.87	55.4727	197.77	49.4727	97.30284	24.3405684	250.17	62.58	2514.68	626.26
9/19/2000 23:40	195.93	55.5458	199.83	49.5458	98.31636	24.3765336	252.77	62.67	2478.47	626.26
9/19/2000 23:50	188.144	55.4727	192.044	49.4727	94.485648	24.3405684	242.92	62.58	2405.25	618.45
9/20/2000 0:00	184.353	54.3106	188.253	48.3106	92.620476	23.7688152	238.13	61.11	2423.67	610.99
9/20/2000 0:10	191.056	54.2943	194.956	48.2943	95.918352	23.7607956	246.61	61.09	2446.81	604.93
9/20/2000 0:20	188.012	53.3516	191.912	47.3516	94.420704	23.2969872	242.76	59.90	2421.12	605.08
9/20/2000 0:30	186.995	54.3187	190.895	48.3187	93.92034	23.7728004	241.47	61.12	2409.30	604.77
9/20/2000 0:40	186.142	53.3029	190.042	47.3029	93.500664	23.2730268	240.39	59.83	2398.51	598.30
9/20/2000 0:50	185.289	53.2947	189.189	47.2947	93.080988	23.2689924	239.31	59.82	2391.76	593.11
9/20/2000 1:00	185.075	52.4821	188.975	46.4821	92.9757	22.8691932	239.04	58.80	2364.62	587.61
Date/Time	In (ppm)	Out (ppm)	In Corr.	Out Corr.	Inlet (mg/m3)	Outlet (mg/m3)	Inlet Load (mg/min)	Outlet Load (mg/min)	Mass In (mg)	Mass Out (mg)

9/20/2000 1:10	180.998	52.4252	184.898	46.4252	90.969816	22.8411984	233.88	58.72	2313.04	581.03
9/20/2000 1:20	176.92	51.4418	180.82	45.4418	88.96344	22.3573656	228.73	57.48	2247.61	561.19
9/20/2000 1:30	170.652	49.2883	174.552	43.2883	85.879584	21.2978436	220.80	54.76	2099.57	542.32
9/20/2000 1:40	153.513	48.4593	157.413	42.4593	77.447196	20.8899756	199.12	53.71	1972.02	523.36
9/20/2000 1:50	150.485	46.2895	154.385	40.2895	75.95742	19.822434	195.29	50.96	1939.32	497.40
9/20/2000 2:00	148.344	44.3554	152.244	38.3554	74.904048	18.8708568	192.58	48.52	1860.87	471.86
9/20/2000 2:10	138.08	42.2505	141.98	36.2505	69.85416	17.835246	179.60	45.85	1770.11	446.62
9/20/2000 2:20	133.994	40.3651	137.894	34.3651	67.843848	16.9076292	174.43	43.47	1699.59	414.39
9/20/2000 2:30	126.93	37.1551	130.83	31.1551	64.36836	15.3283092	165.49	39.41	1602.86	382.53
9/20/2000 2:40	118.701	35.3266	122.601	29.3266	60.319692	14.4286872	155.08	37.10	1505.98	352.10
9/20/2000 2:50	111.612	32.3441	115.512	26.3441	56.831904	12.9612972	146.11	33.32	1403.55	321.41
9/20/2000 3:00	102.505	30.4749	106.405	24.4749	52.35126	12.0416508	134.60	30.96	1306.67	297.87
9/20/2000 3:10	96.2946	28.622	100.195	22.622	49.2957432	11.130024	126.74	28.62	1210.26	266.21
9/20/2000 3:20	87.2615	25.4689	91.1615	19.4689	44.851458	9.5786988	115.31	24.63	1113.33	234.45
9/20/2000 3:30	80.9687	23.5997	84.8687	17.5997	41.7554004	8.6590524	107.35	22.26	1028.33	208.90
9/20/2000 3:40	73.8226	21.4299	77.7226	15.4299	38.2395192	7.5915108	98.31	19.52	957.61	183.41
9/20/2000 3:50	69.786	19.5689	73.686	13.5689	36.253512	6.6758988	93.21	17.16	887.35	158.12
9/20/2000 4:00	62.7137	17.4316	66.6137	11.4316	32.7739404	5.6243472	84.26	14.46	811.48	132.73
9/20/2000 4:10	57.791	15.5543	61.691	9.5543	30.351972	4.7007156	78.03	12.09	735.46	106.98
9/20/2000 4:20	50.6942	13.3601	54.5942	7.3601	26.8603464	3.6211692	69.06	9.31	639.16	87.50
9/20/2000 4:30	42.5635	12.4743	46.4635	6.4743	22.860042	3.1853556	58.77	8.19	567.55	68.58
9/20/2000 4:40	39.372	10.3694	43.272	4.3694	21.289824	2.1497448	54.74	5.53	508.91	48.85
9/20/2000 4:50	33.2925	9.35361	37.1925	3.35361	18.29871	1.64997612	47.05	4.24	419.35	36.82
9/20/2000 5:00	25.2111	8.4678	29.1111	2.4678	14.3226612	1.2141576	36.82	3.12	342.65	25.05
9/20/2000 5:10	21.1663	7.49259	25.0663	1.49259	12.3326196	0.73435428	31.71	1.89	291.02	9.44
9/20/2000 5:20	17.0476	5.30651	20.9476	0	10.3062192	0	26.50	0.00	219.88	0.00
9/20/2000 5:30	9.91796	4.41257	13.818	0	6.79843632	0	17.48	0.00	149.31	0.00
9/20/2000 5:40	5.88956	3.42924	9.78956	0	4.81646352	0	12.38	0.00	103.39	0.00
9/20/2000 5:50	2.657	2.324	6.557	0	3.226044	0	8.29	0.00	82.94	0.00
9/20/2000 19:40	176.895	2.2915	180.795	0	88.95114	0	229.58	0.00	1764.23	155.55
9/20/2000 19:50	93.1687	30.4993	97.0687	24.4993	47.7578004	12.0536556	123.26	31.11	749.06	292.53
9/20/2000 20:00	17.0066	27.5737	20.9066	21.5737	10.2860472	10.6142604	26.55	27.40	1595.03	280.51
9/20/2000 20:10	226.409	28.6058	230.309	22.6058	113.312028	11.1220536	292.46	28.71	2215.40	280.82
					Inlet	**Outlet**	**Inlet Load**	**Outlet Load**		
Date/Time	**In (ppm)**	**Out (ppm)**	**In Corr.**	**Out Corr.**	**(mg/m3)**	**(mg/m3)**	**(mg/min)**	**(mg/min)**	**Mass In (mg)**	**lass Out (mg)**
9/20/2000 20:20	114.714	27.6225	118.614	21.6225	58.358088	10.63827	150.62	27.46	1959.84	316.26
9/20/2000 20:30	186.158	34.1888	190.058	28.1888	93.508536	13.8688896	241.35	35.80	2406.32	371.37

9/20/2000 20:40	185.034	36.3018	188.934	30.3018	92.955528	14.9084856	239.92	38.48	1247.73	192.39
9/20/2000 20:50	3.68256	1.30004	7.58256	0	3.73061952	0	9.63	0.00	3456.29	0.00
9/20/2000 21:00	532.879	1.30004	536.779	0	264.095268	0	681.63	0.00	6722.17	288.47
9/20/2000 21:10	518.054	51.4337	521.954	45.4337	256.801368	22.3533804	662.80	57.69	4578.26	506.66
9/20/2000 21:20	195.216	40.3651	199.116	34.3651	97.965072	16.9076292	252.85	43.64	2483.26	403.98
9/20/2000 21:30	188.094	35.2616	191.994	29.2616	94.461048	14.3967072	243.80	37.16	2404.91	346.40
9/20/2000 21:40	182.876	31.2957	186.776	25.2957	91.893792	12.4454844	237.18	32.12	2371.58	321.32
9/20/2000 21:50	182.844	31.312	186.744	25.312	91.878048	12.453504	237.14	32.14	2372.72	321.42
9/20/2000 22:00	183.057	31.312	186.957	25.312	91.982844	12.453504	237.41	32.14	2348.34	316.16
9/20/2000 22:10	179.004	30.4831	182.904	24.4831	89.988768	12.0456852	232.26	31.09	2295.31	310.80
9/20/2000 22:20	174.705	30.4668	178.605	24.4668	87.87366	12.0376656	226.80	31.07	2263.54	311.00
9/20/2000 22:30	173.999	30.5156	177.899	24.5156	87.526308	12.0616752	225.91	31.13	2231.76	318.02
9/20/2000 22:40	169.7	31.572	173.6	25.572	85.4112	12.581424	220.45	32.47	2230.51	317.81
9/20/2000 22:50	173.802	30.4831	177.702	24.4831	87.429384	12.0456852	225.66	31.09	2236.76	310.90
9/20/2000 23:00	170.685	30.4831	174.585	24.4831	85.89582	12.0456852	221.70	31.09	2184.98	317.92
9/20/2000 23:10	165.647	31.5883	169.547	25.5883	83.417124	12.5894436	215.30	32.49	2158.73	317.81
9/20/2000 23:20	166.55	30.4668	170.45	24.4668	83.8614	12.0376656	216.45	31.07	2159.56	310.80
9/20/2000 23:30	165.778	30.4831	169.678	24.4831	83.481576	12.0456852	215.47	31.09	2160.39	317.92
9/20/2000 23:40	166.681	31.5883	170.581	25.5883	83.925852	12.5894436	216.61	32.49	2185.61	324.73
9/20/2000 23:50	169.749	31.5558	173.649	25.5558	85.435308	12.5734536	220.51	32.45	2178.52	324.52
9/21/2000 0:00	165.565	31.5558	169.465	25.5558	83.37678	12.5734536	215.20	32.45	2152.41	317.70
9/21/2000 0:10	165.647	30.4831	169.547	24.4831	83.417124	12.0456852	215.29	31.09	2056.44	292.61
9/21/2000 0:20	150.469	27.6062	154.369	21.6062	75.949548	10.6302504	196.00	27.43	1906.93	267.31
9/21/2000 0:30	142.117	26.501	146.017	20.501	71.840364	10.086492	185.39	26.03	1854.11	260.17
9/21/2000 0:40	142.166	26.4847	146.066	20.4847	71.864472	10.0784724	185.44	26.01	1854.10	267.07
9/21/2000 0:50	142.133	27.5899	146.033	21.5899	71.848236	10.6222308	185.38	27.41	1841.58	273.86
9/21/2000 1:00	140.213	27.5574	144.113	21.5574	70.903596	10.6062408	182.93	27.36	1802.83	273.84
9/21/2000 1:10	136.045	27.5899	139.945	21.5899	68.85294	10.6222308	177.63	27.40	1652.35	268.36
9/21/2000 1:20	116.519	26.696	120.419	20.696	59.246148	10.182432	152.84	26.27	1528.86	243.28
9/21/2000 1:30	116.601	23.6404	120.501	17.6404	59.286492	8.6790768	152.93	22.39	1523.34	223.67
9/21/2000 1:40	115.665	23.6079	119.565	17.6079	58.82598	8.6630868	151.74	22.35	1524.81	215.92
					Inlet	**Outlet**	**Inlet Load**	**Outlet Load**		
Date/Time	**In (ppm)**	**Out (ppm)**	**In Corr.**	**Out Corr.**	**(mg/m3)**	**(mg/m3)**	**(mg/min)**	**(mg/min)**	**Mass In (mg)**	**Mass Out (mg)**
9/21/2000 1:50	116.847	22.4214	120.747	16.4214	59.407524	8.0793288	153.23	20.84	1524.72	208.59
9/21/2000 2:00	115.665	22.4539	119.565	16.4539	58.82598	8.0953188	151.72	20.88	1522.64	208.57
9/21/2000 2:10	116.535	22.4214	120.435	16.4214	59.25402	8.0793288	152.81	20.84	1529.63	208.56
9/21/2000 2:20	116.781	22.4539	120.681	16.4539	59.375052	8.0953188	153.11	20.88	1524.12	208.55

9/21/2000 2:30	115.682	22.4214	119.582	16.4214	58.834344	8.0793288	151.71	20.83	1524.34	208.53
9/21/2000 2:40	116.83	22.4539	120.73	16.4539	59.39916	8.0953188	153.16	20.87	1524.24	215.43
9/21/2000 2:50	115.682	23.5103	119.582	17.5103	58.834344	8.6150676	151.69	22.21	1568.69	222.11
9/21/2000 3:00	123.853	23.5103	127.753	17.5103	62.854476	8.6150676	162.05	22.21	1523.12	222.10
9/21/2000 3:10	108.511	23.5103	112.411	17.5103	55.306212	8.6150676	142.58	22.21	1452.06	216.52
9/21/2000 3:20	112.663	22.6327	116.563	16.6327	57.348996	8.1832884	147.83	21.09	1477.36	211.04
9/21/2000 3:30	112.515	22.6489	116.415	16.6489	57.27618	8.1912588	147.64	21.11	1450.94	211.03
9/21/2000 3:40	108.511	22.6327	112.411	16.6327	55.306212	8.1832884	142.55	21.09	1418.91	191.34
9/21/2000 3:50	107.477	19.5445	111.377	13.5445	54.797484	6.663894	141.23	17.17	1392.50	171.95
9/21/2000 4:00	104.36	19.577	108.26	13.577	53.26392	6.679884	137.27	17.22	1386.59	171.94
9/21/2000 4:10	106.558	19.5445	110.458	13.5445	54.345336	6.663894	140.05	17.17	1328.98	164.61
9/21/2000 4:20	95.2855	18.423	99.1855	12.423	48.799266	6.112116	125.75	15.75	1276.27	164.50
9/21/2000 4:30	98.2555	19.5283	102.156	13.5283	50.260506	6.6559236	129.51	17.15	1405.57	164.49
9/21/2000 4:40	115.698	18.423	119.598	12.423	58.842216	6.112116	151.61	15.75	1413.18	157.48
9/21/2000 4:50	99.4698	18.423	103.37	12.423	50.8579416	6.112116	131.03	15.75	1302.76	164.47
9/21/2000 5:00	98.2883	19.5283	102.188	13.5283	50.2766436	6.6559236	129.52	17.15	1243.71	171.36
9/21/2000 5:10	90.1659	19.512	94.0659	13.512	46.2804228	6.647904	119.22	17.13	1225.23	171.14
9/21/2000 5:20	95.3839	19.4957	99.2839	13.4957	48.8476788	6.6398844	125.83	17.10	1225.36	165.78
9/21/2000 5:30	90.1987	18.6668	94.0987	12.6668	46.2965604	6.2320656	119.25	16.05	1199.09	160.31
9/21/2000 5:40	91.2489	18.6343	95.1489	12.6343	46.8132588	6.2160756	120.57	16.01	1205.56	160.09
9/21/2000 5:50	91.2325	18.6343	95.1325	12.6343	46.80519	6.2160756	120.54	16.01	1206.11	160.29
9/21/2000 6:00	91.3473	18.6668	95.2473	12.6668	46.8616716	6.2320656	120.68	16.05	1180.47	160.28
9/21/2000 6:10	87.1959	18.6343	91.0959	12.6343	44.8191828	6.2160756	115.41	16.01	1172.91	160.06
9/21/2000 6:20	90.1659	18.6343	94.0659	12.6343	46.2804228	6.2160756	119.17	16.01	1005.61	139.77
9/21/2000 6:30	60.7939	15.4324	64.6939	9.4324	31.8293988	4.6407408	81.95	11.95	821.06	107.65
9/21/2000 6:40	61.04	13.5632	64.94	7.5632	31.95048	3.7210944	82.26	9.58	795.66	75.52
9/21/2000 6:50	56.7901	10.3613	60.6901	4.3613	29.8595292	2.1457596	76.87	5.52	775.24	55.24
9/21/2000 7:00	57.8239	10.3613	61.7239	4.3613	30.3681588	2.1457596	78.18	5.52	781.74	55.24
9/21/2000 7:10	57.8239	10.3613	61.7239	4.3613	30.3681588	2.1457596	78.17	5.52	756.13	55.34
					Inlet	**Outlet**	**Inlet Load**	**Outlet Load**		
Date/Time	**In (ppm)**	**Out (ppm)**	**In Corr.**	**Out Corr.**	**(mg/m3)**	**(mg/m3)**	**(mg/min)**	**(mg/min)**	**Mass In (mg)**	**Mass Out (mg)**
9/21/2000 7:20	53.7873	10.3776	57.6873	4.3776	28.3821516	2.1537792	73.05	5.54	730.42	62.12
9/21/2000 7:30	53.7709	11.434	57.6709	5.434	28.3740828	2.673528	73.03	6.88	704.61	68.81
9/21/2000 7:40	49.7178	11.434	53.6178	5.434	26.3799576	2.673528	67.89	6.88	672.15	68.80
9/21/2000 7:50	48.6513	11.434	52.5513	5.434	25.8552396	2.673528	66.54	6.88	671.80	68.80
9/21/2000 8:00	49.6686	11.434	53.5686	5.434	26.3557512	2.673528	67.82	6.88	665.94	63.45
9/21/2000 8:10	47.7324	10.5889	51.6324	4.5889	25.4031408	2.2577388	65.37	5.81	639.52	57.99

9/21/2000 8:20	45.5007	10.5726	49.4007	4.5726	24.3051444	2.2497192	62.54	5.79	619.22	57.78
9/21/2000 8:30	44.5326	10.5564	48.4326	4.5564	23.8288392	2.2417488	61.31	5.77	612.75	51.40
9/21/2000 8:40	44.4834	9.5649	48.3834	3.5649	23.8046328	1.7539308	61.24	4.51	606.69	45.12
9/21/2000 8:50	43.5809	9.5649	47.4809	3.5649	23.3606028	1.7539308	60.10	4.51	574.77	45.12
9/21/2000 9:00	39.4458	9.5649	43.3458	3.5649	21.3261336	1.7539308	54.86	4.51	548.26	45.12
9/21/2000 9:10	39.3966	9.5649	43.2966	3.5649	21.3019272	1.7539308	54.79	4.51	555.49	45.11
9/21/2000 9:20	40.5945	9.5649	44.4945	3.5649	21.891294	1.7539308	56.31	4.51	562.10	45.11
9/21/2000 9:30	40.4468	9.5649	44.3468	3.5649	21.8186256	1.7539308	56.11	4.51	528.43	45.11
9/21/2000 9:40	35.278	9.5649	39.178	3.5649	19.275576	1.7539308	49.57	4.51	522.79	45.10
9/21/2000 9:50	39.5607	9.5649	43.4607	3.5649	21.3826644	1.7539308	54.99	4.51	529.40	24.44
9/21/2000 10:00	36.3281	6.29797	40.2281	0.29797	19.7922252	0.14660124	50.89	0.38	509.96	3.77
9/21/2000 10:10	36.4922	6.29797	40.3922	0.29797	19.8729624	0.14660124	51.10	0.38	504.22	3.77
9/21/2000 10:20	35.4257	6.29797	39.3257	0.29797	19.3482444	0.14660124	49.75	0.38	504.19	3.77
9/21/2000 10:30	36.4922	6.29797	40.3922	0.29797	19.8729624	0.14660124	51.09	0.38	504.47	1.88
9/21/2000 10:40	35.4749	5.30651	39.3749	0	19.3724508	0	49.80	0.00	504.44	1.88
9/21/2000 10:50	36.4922	6.29797	40.3922	0.29797	19.8729624	0.14660124	51.09	0.38	484.69	3.77
9/21/2000 11:00	32.3572	6.29797	36.2572	0.29797	17.8385424	0.14660124	45.85	0.38	458.20	1.88
9/21/2000 11:10	32.308	5.30651	36.208	0	17.814336	0	45.79	0.00	477.89	0.00
9/21/2000 11:20	35.4749	5.30651	39.3749	0	19.3724508	0	49.79	0.00	477.86	0.00
9/21/2000 11:30	32.308	5.30651	36.208	0	17.814336	0	45.78	0.00	451.06	0.00
9/21/2000 11:40	31.2414	5.29025	35.1414	0	17.2895688	0	44.43	0.00	444.29	0.00
9/21/2000 11:50	31.2414	5.29025	35.1414	0	17.2895688	0	44.43	0.00	444.27	1.88
9/21/2000 12:00	31.2414	6.29797	35.1414	0.29797	17.2895688	0.14660124	44.43	0.38	445.28	1.88
9/21/2000 12:10	31.4055	5.29025	35.3055	0	17.370306	0	44.63	0.00	423.99	0.00
9/21/2000 12:20	27.8775	5.29025	31.7775	0	15.63453	0	40.17	0.00	401.68	0.00
9/23/2000 16:10	242.802	10.5401	246.702	4.5401	121.377384	2.2337292	311.82	5.74	2586.10	76.39
9/23/2000 16:20	158.608	13.547	162.508	7.547	79.953936	3.713124	205.40	9.54	2130.13	202.52
					Inlet	**Outlet**	**Inlet Load**	**Outlet Load**		
Date/Time	**In (ppm)**	**Out (ppm)**	**In Corr.**	**Out Corr.**	**(mg/m3)**	**(mg/m3)**	**(mg/min)**	**(mg/min)**	**Mass In (mg)**	**Mass Out (mg)**
9/23/2000 16:30	170.652	30.4993	174.552	24.4993	85.879584	12.0536556	220.62	30.97	2225.95	290.96
9/23/2000 16:40	173.769	27.5412	177.669	21.5412	87.413148	10.5982704	224.56	27.23	2272.50	352.70
9/23/2000 16:50	178.019	40.2676	181.919	34.2676	89.504148	16.8596592	229.94	43.31	1564.96	560.91
9/23/2000 17:00	61.8112	60.4869	65.7112	54.4869	32.3299104	26.8075548	83.06	68.87	1672.50	580.63
9/23/2000 17:10	195.035	43.3883	198.935	37.3883	97.87602	18.3950436	251.44	47.26	2463.83	472.36
9/23/2000 17:20	187.028	43.3558	190.928	37.3558	93.936576	18.3790536	241.32	47.22	2394.25	471.64
9/23/2000 17:30	184.025	43.2745	187.925	37.2745	92.4591	18.339054	237.53	47.11	2349.04	477.60
9/23/2000 17:40	179.874	44.2985	183.774	38.2985	90.416808	18.842862	232.28	48.41	2290.87	477.60

9/23/2000 17:50	174.82	43.2745	178.72	37.2745	87.93024	18.339054	225.89	47.11	2226.78	452.54
9/23/2000 18:00	169.733	40.3326	173.633	34.3326	85.427436	16.8916392	219.46	43.39	2143.09	427.68
9/23/2000 18:10	161.578	39.3412	165.478	33.3412	81.415176	16.4038704	209.16	42.14	2047.48	420.80
9/23/2000 18:20	154.604	39.2437	158.504	33.2437	77.983968	16.3559004	200.34	42.02	1939.53	401.39
9/23/2000 18:30	144.496	36.2693	148.396	30.2693	73.010832	14.8924956	187.56	38.26	1848.17	382.49
9/23/2000 18:40	140.148	36.253	144.048	30.253	70.871616	14.884476	182.07	38.24	1743.95	375.91
9/23/2000 18:50	128.005	35.2291	131.905	29.2291	64.89726	14.3807172	166.72	36.94	1647.30	339.34
9/23/2000 19:00	124.854	30.4668	128.754	24.4668	63.346968	12.0376656	162.74	30.92	1550.34	316.23
9/23/2000 19:10	112.663	31.572	116.563	25.572	57.348996	12.581424	147.33	32.32	1473.19	298.05
9/23/2000 19:20	112.646	27.5899	116.546	21.5899	57.340632	10.6222308	147.31	27.29	1440.62	265.80
9/23/2000 19:30	107.51	26.4685	111.41	20.4685	54.81372	10.070502	140.82	25.87	1376.02	265.70
9/23/2000 19:40	102.423	27.5737	106.323	21.5737	52.310916	10.6142604	134.39	27.27	1292.12	267.13
9/23/2000 19:50	94.2353	26.696	98.1353	20.696	48.2825676	10.182432	124.04	26.16	1196.62	234.57
9/23/2000 20:00	87.3107	22.4214	91.2107	16.4214	44.8756644	8.0793288	115.29	20.76	1145.49	214.34
9/23/2000 20:10	86.1457	23.4941	90.0457	17.4941	44.3024844	8.6070972	113.81	22.11	1093.23	215.57
9/23/2000 20:20	79.0406	22.6164	82.9406	16.6164	40.8067752	8.1752688	104.83	21.00	1022.09	183.42
9/23/2000 20:30	74.8892	18.4068	78.7892	12.4068	38.7642864	6.1041456	99.59	15.68	957.28	163.70
9/23/2000 20:40	68.785	19.4957	72.685	13.4957	35.76102	6.6398844	91.87	17.06	899.00	165.03
9/23/2000 20:50	65.6673	18.6181	69.5673	12.6181	34.2271116	6.2081052	87.93	15.95	855.55	139.87
9/23/2000 21:00	61.9097	15.5137	65.8097	9.5137	32.3783724	4.6807404	83.18	12.02	806.19	112.85
9/23/2000 21:10	57.8567	14.3434	61.7567	8.3434	30.3842964	4.1049528	78.06	10.55	748.63	112.34
9/23/2000 21:20	52.8027	15.4324	56.7027	9.4324	27.8977284	4.6407408	71.67	11.92	691.29	113.67
9/23/2000 21:30	48.7825	14.5547	52.6825	8.5547	25.91979	4.2089124	66.59	10.81	633.01	101.76
9/23/2000 21:40	43.5809	13.547	47.4809	7.547	23.3606028	3.713124	60.01	9.54	575.04	75.26
9/23/2000 21:50	39.6099	10.3613	43.5099	4.3613	21.4068708	2.1457596	54.99	5.51	503.69	61.90
					Inlet	**Outlet**	**Inlet Load**	**Outlet Load**		
Date/Time	**In (ppm)**	**Out (ppm)**	**In Corr.**	**Out Corr.**	**(mg/m3)**	**(mg/m3)**	**(mg/min)**	**(mg/min)**	**Mass In (mg)**	**Mass Out (mg)**
9/23/2000 22:00	32.2915	11.434	36.1915	5.434	17.806218	2.673528	45.74	6.87	458.38	63.14
9/23/2000 22:10	32.4392	10.5564	36.3392	4.5564	17.8788864	2.2417488	45.93	5.76	427.27	51.22
9/23/2000 22:20	27.3689	9.54865	31.2689	3.54865	15.3842988	1.7459358	39.52	4.49	375.31	44.96
9/23/2000 22:30	24.2184	9.5649	28.1184	3.5649	13.8342528	1.7539308	35.54	4.51	322.53	24.41
9/23/2000 22:40	19.0167	6.29797	22.9167	0.29797	11.2750164	0.14660124	28.97	0.38	271.20	1.88
9/23/2000 22:50	16.0959	5.29025	19.9959	0	9.8379828	0	25.27	0.00	226.19	3.12
9/23/2000 23:00	11.8952	6.49301	15.7952	0.49301	7.7712384	0.24256092	19.96	0.62	187.61	6.33
9/23/2000 23:10	9.9918	6.50926	13.8918	0.50926	6.8347656	0.25055592	17.56	0.64	123.94	3.22
9/23/2000 23:20	1.82015	5.50155	5.72015	0	2.8143138	0	7.23	0.00	72.40	0.00
9/23/2000 23:30	1.83655	2.29962	5.73655	0	2.8223826	0	7.25	0.00	72.51	0.00

9/26/2000 19:20	100.38	1.27566	104.28	0	51.30576	0	132.83	0.00	1757.68	111.83
9/26/2000 19:30	167.797	23.5591	171.697	17.5591	84.474924	8.6390772	218.71	22.37	2186.85	291.42
9/26/2000 19:40	167.764	34.197	171.664	28.197	84.458688	13.872924	218.66	35.92	2199.28	372.42
9/26/2000 19:50	169.749	36.2774	173.649	30.2774	85.435308	14.8964808	221.19	38.57	2167.66	391.21
9/26/2000 20:00	162.8	37.147	166.7	31.147	82.0164	15.324324	212.34	39.67	2109.82	417.24
9/26/2000 20:10	160.667	40.3651	164.567	34.3651	80.966964	16.9076292	209.62	43.77	2089.55	417.29
9/26/2000 20:20	159.617	37.1551	163.517	31.1551	80.450364	15.3283092	208.29	39.68	2089.91	429.15
9/26/2000 20:30	160.724	42.2262	164.624	36.2262	80.995008	17.8232904	209.70	46.14	2065.19	461.24
9/26/2000 20:40	155.736	42.1936	159.636	36.1936	78.540912	17.8072512	203.34	46.10	2018.95	461.39
9/26/2000 20:50	153.463	42.2505	157.363	36.2505	77.422596	17.835246	200.45	46.18	2004.37	468.74
9/26/2000 21:00	153.447	43.3476	157.347	37.3476	77.414724	18.3750192	200.43	47.57	1940.05	475.52
9/26/2000 21:10	143.364	43.3151	147.264	37.3151	72.453888	18.3590292	187.58	47.53	1843.80	468.64
9/26/2000 21:20	138.334	42.2668	142.234	36.2668	69.979128	17.8432656	181.18	46.20	1817.20	461.65
9/26/2000 21:30	139.188	42.218	143.088	36.218	70.399296	17.819256	182.26	46.13	1835.23	461.34
9/26/2000 21:40	141.165	42.218	145.065	36.218	71.37198	17.819256	184.78	46.13	1842.96	461.65
9/26/2000 21:50	140.402	42.2668	144.302	36.2668	70.996584	17.8432656	183.81	46.20	1849.44	461.70
9/26/2000 22:00	142.182	42.2262	146.082	36.2262	71.872344	17.8232904	186.08	46.14	1828.59	454.97
9/26/2000 22:10	137.128	41.2103	141.028	35.2103	69.385776	17.3234676	179.64	44.85	1802.88	429.35
9/26/2000 22:20	138.146	38.2034	142.046	32.2034	69.886632	15.8440728	180.94	41.02	1803.87	409.89
9/26/2000 22:30	137.284	38.1547	141.184	32.1547	69.462528	15.8201124	179.84	40.96	1797.29	397.57
9/26/2000 22:40	137.112	36.2693	141.012	30.2693	69.377904	14.8924956	179.62	38.56	1784.96	391.05
9/26/2000 22:50	135.348	37.1307	139.248	31.1307	68.510016	15.3163044	177.37	39.65	1779.42	391.26
9/26/2000 23:00	136.242	36.3018	140.142	30.3018	68.949864	14.9084856	178.51	38.60	1765.20	385.93
Date/Time	**In (ppm)**	**Out (ppm)**	**In Corr.**	**Out Corr.**	**Inlet (mg/m3)**	**Outlet (mg/m3)**	**Inlet Load (mg/min)**	**Outlet Load (mg/min)**	**Mass In (mg)**	**Mass Out (mg)**
9/26/2000 23:10	133.116	36.2937	137.016	30.2937	67.411872	14.9045004	174.53	38.59	1725.49	386.03
9/26/2000 23:20	130.007	36.318	133.907	30.318	65.882244	14.916456	170.57	38.62	1673.13	379.56
9/26/2000 23:30	124.895	35.2778	128.795	29.2778	63.36714	14.4046776	164.06	37.29	1568.85	347.71
9/26/2000 23:40	113.647	31.3201	117.547	25.3201	57.833124	12.4574892	149.71	32.25	1458.33	322.47
9/26/2000 23:50	107.568	31.3201	111.468	25.3201	54.842256	12.4574892	141.95	32.24	1393.59	317.10
9/27/2000 0:00	103.506	30.4831	107.406	24.4831	52.843752	12.0456852	136.76	31.18	1334.82	299.68
9/27/2000 0:10	98.3622	28.5895	102.262	22.5895	50.3130024	11.114034	130.20	28.76	1269.28	273.94
9/27/2000 0:20	93.2344	26.4441	97.1344	20.4441	47.7901248	10.0584972	123.66	26.03	1204.44	248.40
9/27/2000 0:30	88.1968	24.5831	92.0968	18.5831	45.3116256	9.1428852	117.23	23.65	1133.13	230.17
9/27/2000 0:40	82.0517	23.5835	85.9517	17.5835	42.2882364	8.651082	109.40	22.38	1061.68	216.34
9/27/2000 0:50	76.9895	22.4132	80.8895	16.4132	39.797634	8.0752944	102.94	20.89	1003.04	202.40
9/27/2000 1:00	72.8545	21.3974	76.7545	15.3974	37.763214	7.5755208	97.67	19.59	950.88	190.54

9/27/2000 1:10	68.8096	20.5522	72.7096	14.5522	35.7731232	7.1596824	92.51	18.51	899.05	178.57
9/27/2000 1:20	64.7238	19.5201	68.6238	13.5201	33.7629096	6.6518892	87.30	17.20	848.74	158.45
9/27/2000 1:30	60.9169	17.3909	64.8169	11.3909	31.8899148	5.6043228	82.45	14.49	791.62	144.99
9/27/2000 1:40	55.7563	17.4072	59.6563	11.4072	29.3508996	5.6123424	75.88	14.51	746.19	125.59
9/27/2000 1:50	53.7873	14.3434	57.6873	8.3434	28.3821516	4.1049528	73.36	10.61	714.17	106.05
9/27/2000 2:00	50.7352	14.3353	54.6352	8.3353	26.8805184	4.1009676	69.47	10.60	654.94	99.47
9/27/2000 2:10	44.4834	13.3113	48.3834	7.3113	23.8046328	3.5971596	61.52	9.30	603.13	87.58
9/27/2000 2:20	42.5964	12.4661	46.4964	6.4661	22.8762288	3.1813212	59.11	8.22	570.78	82.25
9/27/2000 2:30	39.4048	12.4743	43.3048	6.4743	21.3059616	3.1853556	55.05	8.23	545.11	75.84
9/27/2000 2:40	38.568	11.4584	42.468	5.4584	20.894256	2.6855328	53.98	6.94	513.14	69.32
9/27/2000 2:50	34.3837	11.4503	38.2837	5.4503	18.8355804	2.6815476	48.65	6.93	480.08	62.13
9/27/2000 3:00	33.3745	10.3288	37.2745	4.3288	18.339054	2.1297696	47.36	5.50	460.06	55.00
9/27/2000 3:10	31.2414	10.3288	35.1414	4.3288	17.2895688	2.1297696	44.65	5.50	434.26	48.75
9/27/2000 3:20	29.3215	9.34548	33.2215	3.34548	16.344978	1.64597616	42.20	4.25	408.37	42.45
9/27/2000 3:30	27.172	9.33736	31.072	3.33736	15.287424	1.64198112	39.47	4.24	389.09	36.92
9/27/2000 3:40	26.2941	8.47592	30.1941	2.47592	14.8554972	1.21815264	38.35	3.14	363.42	31.39
9/27/2000 3:50	23.1354	8.4678	27.0354	2.4678	13.3014168	1.2141576	34.33	3.13	337.90	24.99
9/27/2000 4:00	22.2821	7.46821	26.1821	1.46821	12.8815932	0.72235932	33.25	1.86	325.57	18.64
9/27/2000 4:10	21.1991	7.46821	25.0991	1.46821	12.3487572	0.72235932	31.87	1.86	311.73	11.16
9/27/2000 4:20	20.1079	6.28984	24.0079	0.28984	11.8118868	0.14260128	30.48	0.37	292.16	3.47
9/27/2000 4:30	18.1224	6.25733	22.0224	0.25733	10.8350208	0.12660636	27.95	0.33	272.97	3.37
Date/Time	**In (ppm)**	**Out (ppm)**	**In Corr.**	**Out Corr.**	**Inlet (mg/m3)**	**Outlet (mg/m3)**	**Inlet Load (mg/min)**	**Outlet Load (mg/min)**	**Mass In (mg)**	**Mass Out (mg)**
9/27/2000 4:40	17.0887	6.27359	20.9887	0.27359	10.3264404	0.13460628	26.64	0.35	259.71	1.74
9/27/2000 4:50	16.0385	5.28213	19.9385	0	9.809742	0	25.30	0.00	240.63	0.00
9/27/2000 5:00	14.0858	5.274	17.9858	0	8.8490136	0	22.82	0.00	221.60	0.00
9/27/2000 5:10	13.0439	4.40444	16.9439	0	8.3363988	0	21.50	0.00	207.58	0.00
9/27/2000 5:20	11.8788	4.39632	15.7788	0	7.7631696	0	20.02	0.00	193.45	0.00
9/27/2000 5:30	10.8205	4.39632	14.7205	0	7.242486	0	18.67	0.00	181.10	0.00
9/27/2000 5:40	9.93437	4.39632	13.8344	0	6.80651004	0	17.55	0.00	175.40	0.00
9/27/2000 5:50	9.92616	3.40486	13.8262	0	6.80247072	0	17.53	0.00	168.78	0.00
9/27/2000 6:00	8.8924	3.3886	12.7924	0	6.2938608	0	16.22	0.00	155.60	0.00
9/27/2000 6:10	7.85043	3.3886	11.7504	0	5.78121156	0	14.90	0.00	142.37	0.00
9/27/2000 6:20	6.80846	3.3886	10.7085	0	5.26856232	0	13.58	0.00	135.64	0.00
9/27/2000 6:30	6.79205	3.3886	10.6921	0	5.2604886	0	13.55	0.00	129.91	0.00
9/27/2000 6:40	5.90597	2.27524	9.80597	0	4.82453724	0	12.43	0.00	117.52	0.00
9/27/2000 6:50	4.83939	2.27524	8.73939	0	4.29977988	0	11.08	0.00	110.70	0.00

9/27/2000 7:00	4.83119	2.27524	8.73119	0	4.29574548	0	11.06	0.00	110.68	0.00
9/27/2000 7:10	4.83939	2.28337	8.73939	0	4.29977988	0	11.07	0.00	103.65	0.00
9/27/2000 7:20	3.72358	2.27524	7.62358	0	3.75080136	0	9.66	0.00	96.57	0.00
9/27/2000 7:30	3.72358	1.27566	7.62358	0	3.75080136	0	9.66	0.00	89.81	0.00
9/27/2000 7:40	2.657	1.26753	6.557	0	3.226044	0	8.30	0.00	82.99	0.00
9/27/2000 7:50	2.6488	1.26753	6.5488	0	3.2220096	0	8.29	0.00	82.93	0.00
9/27/2000 8:00	2.6488	1.26753	6.5488	0	3.2220096	0	8.29	0.00	77.31	0.00
9/27/2000 8:10	1.76271	1.26753	5.66271	0	2.78605332	0	7.17	0.00	71.69	0.00
9/27/2000 8:20	1.76271	1.26753	5.66271	0	2.78605332	0	7.17	0.00	71.63	0.00
9/27/2000 8:30	1.75451	1.26753	5.65451	0	2.78201892	0	7.16	0.00	71.62	0.00
9/27/2000 8:40	1.76271	1.26753	5.66271	0	2.78605332	0	7.17	0.00	71.62	0.00
9/27/2000 8:50	1.75451	1.25941	5.65451	0	2.78201892	0	7.16	0.00	71.61	0.00
9/27/2000 9:00	1.76271	1.29191	5.66271	0	2.78605332	0	7.17	0.00	71.65	0.00
9/27/2000 9:10	1.76271	1.25941	5.66271	0	2.78605332	0	7.16	0.00	65.00	0.00
9/27/2000 9:20	0.71254	1.26753	4.61254	0	2.26937066	0	5.84	0.00	65.04	0.00
9/27/2000 9:30	1.77092	1.27566	5.67092	0	2.79009264	0	7.17	0.00	65.04	0.00
9/27/2000 9:40	0.71254	1.27566	4.61254	0	2.26937066	0	5.83	0.00	58.34	0.00
9/27/2000 9:50	0.71254	1.27566	4.61254	0	2.26937066	0	5.83	0.00	58.33	0.00
9/27/2000 10:00	0.71254	1.26753	4.61254	0	2.26937066	0	5.83	0.00	58.32	0.00
					Inlet	**Outlet**	**Inlet Load**	**Outlet Load**		
Date/Time	**In (ppm)**	**Out (ppm)**	**In Corr.**	**Out Corr.**	**(mg/m3)**	**(mg/m3)**	**(mg/min)**	**(mg/min)**	**Mass In (mg)**	**Mass Out (mg)**
9/27/2000 10:10	0.71254	1.26753	4.61254	0	2.26937066	0	5.83	0.00	58.31	0.00
9/27/2000 10:20	0.71254	1.26753	4.61254	0	2.26937066	0	5.83	0.00	58.31	0.00
9/27/2000 10:30	0.71254	1.26753	4.61254	0	2.26937066	0	5.83	0.00	58.30	0.00
9/27/2000 18:50	149.337	10.5564	153.237	4.5564	75.392604	2.2417488	188.78	5.61	2013.26	178.68
9/27/2000 19:00	169.7	30.4506	173.6	24.4506	85.4112	12.0296952	213.87	30.12	2682.49	436.18
9/27/2000 19:10	257.98	52.3602	261.88	46.3602	128.84496	22.8092184	322.63	57.11	3211.12	565.04
9/27/2000 19:20	255.519	51.3687	259.419	45.3687	127.634148	22.3214004	319.60	55.89	3113.78	565.44
9/27/2000 19:30	242.178	52.4252	246.078	46.4252	121.070376	22.8411984	303.16	57.19	2998.45	565.74
9/27/2000 19:40	236.796	51.4175	240.696	45.4175	118.422432	22.34541	296.53	55.95	2946.80	559.43
9/27/2000 19:50	233.793	51.4012	237.693	45.4012	116.944956	22.3373904	292.83	55.93	2879.79	541.01
9/27/2000 20:00	225.917	48.4268	229.817	42.4268	113.069964	20.8739856	283.13	52.27	2848.35	516.08
9/27/2000 20:10	228.69	47.3541	232.59	41.3541	114.43428	20.3462172	286.54	50.95	2898.49	509.87
9/27/2000 20:20	234.056	47.4191	237.956	41.4191	117.074352	20.3781972	293.15	51.03	2929.42	509.77
9/27/2000 20:30	233.711	47.3379	237.611	41.3379	116.904612	20.3382468	292.73	50.93	2958.12	515.28
9/27/2000 20:40	238.716	48.3131	242.616	42.3131	119.367072	20.8180452	298.90	52.13	2978.74	466.02
9/27/2000 20:50	237.059	39.3412	240.959	33.3412	118.551828	16.4038704	296.85	41.08	2967.02	441.59

9/27/2000 21:00	236.813	44.3472	240.713	38.3472	118.430796	18.8668224	296.55	47.24	3022.11	466.32
9/27/2000 21:10	246.002	43.3558	249.902	37.3558	122.951784	18.3790536	307.87	46.02	3053.94	466.12
9/27/2000 21:20	241.981	44.3147	245.881	38.3147	120.973452	18.8508324	302.92	47.20	3049.50	466.32
9/27/2000 21:30	245.28	43.3883	249.18	37.3883	122.59656	18.3950436	306.98	46.06	3074.77	466.32
9/27/2000 21:40	246.084	44.3147	249.984	38.3147	122.992128	18.8508324	307.97	47.20	3111.05	472.23
9/27/2000 21:50	251.17	44.3472	255.07	38.3472	125.49444	18.8668224	314.24	47.24	3135.61	497.46
9/27/2000 22:00	250.071	48.4106	253.971	42.4106	124.953732	20.8660152	312.88	52.25	3128.54	497.46
9/27/2000 22:10	250.022	44.3472	253.922	38.3472	124.929624	18.8668224	312.82	47.24	3103.78	497.05
9/27/2000 22:20	246.051	48.3456	249.951	42.3456	122.975892	20.8340352	307.93	52.17	3111.96	490.55
9/27/2000 22:30	251.351	43.2908	255.251	37.2908	125.583492	18.3470736	314.46	45.94	3111.76	490.85
9/27/2000 22:40	246.018	48.3943	249.918	42.3943	122.959656	20.8579956	307.89	52.23	3021.90	522.68
9/27/2000 22:50	236.763	48.4593	240.663	42.4593	118.406196	20.8899756	296.49	52.31	2946.09	522.18
9/27/2000 23:00	233.711	48.3131	237.611	42.3131	116.904612	20.8180452	292.73	52.13	2877.77	477.48
9/27/2000 23:10	225.671	41.2022	229.571	35.2022	112.948932	17.3194824	282.82	43.37	2746.22	422.32
9/27/2000 23:20	212.355	39.3574	216.255	33.3574	106.39746	16.4118408	266.42	41.10	2583.01	372.72
9/27/2000 23:30	199.277	33.1649	203.177	27.1649	99.963084	13.3651308	250.18	33.45	2350.50	341.81
9/27/2000 23:40	174.787	34.3676	178.687	28.3676	87.914004	13.9568592	219.92	34.91	2117.27	319.00
					Inlet	**Outlet**	**Inlet Load**	**Outlet Load**		
Date/Time	**In (ppm)**	**Out (ppm)**	**In Corr.**	**Out Corr.**	**(mg/m3)**	**(mg/m3)**	**(mg/min)**	**(mg/min)**	**Mass In (mg)**	**Mass Out (mg)**
9/27/2000 23:50	161.561	29.4835	165.461	23.4835	81.406812	11.553882	203.54	28.89	1941.46	296.15
9/28/2000 0:00	146.367	30.6781	150.267	24.6781	73.931364	12.1416252	184.75	30.34	1766.52	284.07
9/28/2000 0:10	133.256	27.5412	137.156	21.5412	67.480752	10.5982704	168.55	26.47	1609.40	240.40
9/28/2000 0:20	120.933	23.5916	124.833	17.5916	61.417836	8.6550672	153.33	21.61	1450.72	215.52
9/28/2000 0:30	107.543	23.5103	111.443	17.5103	54.829956	8.6150676	136.81	21.50	1286.86	190.48
9/28/2000 0:40	94.3502	19.5283	98.2502	13.5283	48.3390984	6.6559236	120.56	16.60	1111.09	165.66
9/28/2000 0:50	78.9914	19.4795	82.8914	13.4795	40.7825688	6.631914	101.66	16.53	934.99	133.80
9/28/2000 1:00	65.7166	14.3434	69.6166	8.3434	34.2513672	4.1049528	85.34	10.23	805.51	103.64
9/28/2000 1:10	57.9387	14.571	61.8387	8.571	30.4246404	4.216932	75.76	10.50	675.17	79.06
9/28/2000 1:20	44.4998	10.3369	48.3998	4.3369	23.8127016	2.1337548	59.27	5.31	517.99	35.54
9/28/2000 1:30	32.3162	7.46821	36.2162	1.46821	17.8183704	0.72235932	44.33	1.80	375.47	10.61
9/28/2000 1:40	21.2483	6.26546	25.1483	0.26546	12.3729636	0.13060632	30.77	0.32	250.44	1.62
9/28/2000 1:50	11.9034	3.40486	15.8034	0	7.7752728	0	19.32	0.00	143.30	0.00
9/28/2000 2:00	3.73999	2.28337	7.63999	0	3.75887508	0	9.34	0.00	93.37	0.00
9/28/2000 16:10	120.883	10.3288	124.783	4.3288	61.393236	2.1297696	143.29	4.97	1719.62	102.53
9/28/2000 16:20	170.816	19.5283	174.716	13.5283	85.960272	6.6559236	200.63	15.53	1790.00	178.03
9/28/2000 16:30	133.141	23.4778	137.041	17.4778	67.424172	8.5990776	157.37	20.07	2516.11	223.94
9/28/2000 16:40	297.28	27.5249	301.18	21.5249	148.18056	10.5902508	345.85	24.72	3258.89	241.02

9/28/2000 16:50	262.509	26.4522	266.409	20.4522	131.073228	10.0624824	305.92	23.49	3011.20	314.55
9/28/2000 17:00	254.14	40.3326	258.04	34.3326	126.95568	16.8916392	296.31	39.43	2922.64	388.00
9/28/2000 17:10	247.085	39.2437	250.985	33.2437	123.48462	16.3559004	288.21	38.17	2881.47	336.21
9/28/2000 17:20	246.97	31.312	250.87	25.312	123.42804	12.453504	288.08	29.07	2899.09	290.48
9/28/2000 17:30	250.153	31.2795	254.053	25.2795	124.994076	12.437514	291.74	29.03	2917.83	312.88
9/28/2000 17:40	250.235	35.2128	254.135	29.2128	125.03442	14.3726976	291.83	33.55	2841.05	341.80
9/28/2000 17:50	236.78	36.318	240.68	30.318	118.41456	14.916456	276.38	34.82	2746.65	347.68
9/28/2000 18:00	233.793	36.2368	237.693	30.2368	116.944956	14.8765056	272.95	34.72	2752.96	364.48
9/28/2000 18:10	237.879	39.2437	241.779	33.2437	118.955268	16.3559004	277.64	38.17	2683.99	381.65
9/28/2000 18:20	221.782	39.2274	225.682	33.2274	111.035544	16.3478808	259.16	38.16	2515.82	364.39
9/28/2000 18:30	208.589	36.2368	212.489	30.2368	104.544588	14.8765056	244.01	34.72	2410.39	320.34
9/28/2000 18:40	203.42	31.5558	207.32	25.5558	102.00144	12.5734536	238.07	29.35	2317.59	288.61
9/28/2000 18:50	192.426	30.7106	196.326	24.7106	96.592392	12.1576152	225.45	28.38	2178.77	259.44
9/28/2000 19:00	179.332	26.4847	183.232	20.4847	90.150144	10.0784724	210.31	23.51	2031.02	236.18
9/28/2000 19:10	166.861	26.6798	170.761	20.6798	84.014412	10.1744616	195.90	23.72	1882.56	219.47
					Inlet	**Outlet**	**Inlet Load**	**Outlet Load**		
Date/Time	**In (ppm)**	**Out (ppm)**	**In Corr.**	**Out Corr.**	**(mg/m3)**	**(mg/m3)**	**(mg/min)**	**(mg/min)**	**Mass In (mg)**	**Mass Out (mg)**
9/28/2000 19:20	153.619	23.5916	157.519	17.5916	77.499348	8.6550672	180.62	20.17	1729.18	201.10
9/28/2000 19:30	140.262	23.4941	144.162	17.4941	70.927704	8.6070972	165.22	20.05	1563.91	177.73
9/28/2000 19:40	124.92	19.5283	128.82	13.5283	63.37944	6.6559236	147.56	15.50	1399.55	155.02
9/28/2000 19:50	111.694	19.5445	115.594	13.5445	56.872248	6.663894	132.35	15.51	1269.92	154.57
9/28/2000 20:00	102.391	19.4632	106.291	13.4632	52.295172	6.6238944	121.64	15.41	1146.61	149.20
9/28/2000 20:10	90.2479	18.6181	94.1479	12.6181	46.3207668	6.2081052	107.69	14.43	1030.64	126.08
9/28/2000 20:20	82.2075	15.4324	86.1075	9.4324	42.36489	4.6407408	98.44	10.78	907.39	97.04
9/28/2000 20:30	68.7686	13.547	72.6686	7.547	35.7529512	3.713124	83.04	8.62	784.99	68.02
9/28/2000 20:40	60.8595	10.3613	64.7595	4.3613	31.861674	2.1457596	73.96	4.98	692.89	50.82
9/28/2000 20:50	52.7043	10.5401	56.6043	4.5401	27.8493156	2.2337292	64.62	5.18	599.71	46.16
9/28/2000 21:00	44.5901	9.54865	48.4901	3.54865	23.8571292	1.7459358	55.33	4.05	484.12	20.24
9/28/2000 21:10	32.4885	5.274	36.3885	0	17.903142	0	41.50	0.00	368.68	2.81
9/28/2000 21:20	24.3824	6.49301	28.2824	0.49301	13.9149408	0.24256092	32.24	0.56	269.86	2.81
9/28/2000 21:30	15.177	5.4853	19.077	0	9.385884	0	21.73	0.00	170.76	0.00
9/28/2000 21:40	7.00537	2.29962	10.9054	0	5.36544204	0	12.42	0.00	94.93	0.00
9/28/2000 21:50	1.82015	1.27566	5.72015	0	2.8143138	0	6.57	0.00	65.69	0.00
9/29/2000 17:20	136.226	11.4015	140.126	5.4015	68.941992	2.657538	235.51	9.08	2432.55	151.15
9/29/2000 17:30	145.448	18.5856	149.348	12.5856	73.479216	6.1921152	251.01	21.15	2055.56	286.92
9/29/2000 17:40	91.3637	27.5574	95.2637	21.5574	46.8697404	10.6062408	160.11	36.23	2481.22	320.79
9/29/2000 17:50	196.102	22.6164	200.002	16.6164	98.400984	8.1752688	336.14	27.93	3320.84	286.51

9/29/2000 18:00	191.278	23.4778	195.178	17.4778	96.027576	8.5990776	328.03	29.37	3320.29	286.37
9/29/2000 18:10	196.036	22.6001	199.936	16.6001	98.368512	8.1672492	336.03	27.90	3250.65	277.22
9/29/2000 18:20	182.991	22.3889	186.891	16.3889	91.950372	8.0633388	314.10	27.54	3134.41	277.22
9/29/2000 18:30	182.204	22.6001	186.104	16.6001	91.563168	8.1672492	312.78	27.90	3109.18	286.37
9/29/2000 18:40	179.988	23.4778	183.888	17.4778	90.472896	8.5990776	309.06	29.37	3074.01	293.74
9/29/2000 18:50	178.019	23.4778	181.919	17.4778	89.504148	8.5990776	305.75	29.37	3100.62	293.74
9/29/2000 19:00	183.155	23.4778	187.055	17.4778	92.03106	8.5990776	314.38	29.37	3109.59	284.73
9/29/2000 19:10	179.086	22.4051	182.986	16.4051	90.029112	8.0713092	307.54	27.57	2996.52	284.73
9/29/2000 19:20	169.7	23.4778	173.6	17.4778	85.4112	8.5990776	291.76	29.37	2928.40	293.74
9/29/2000 19:30	170.98	23.4778	174.88	17.4778	86.04096	8.5990776	293.92	29.37	2939.46	293.79
9/29/2000 19:40	171.128	23.4941	175.028	17.4941	86.113776	8.6070972	293.98	29.38	2961.66	284.59
9/29/2000 19:50	173.851	22.4051	177.751	16.4051	87.453492	8.0713092	298.36	27.54	2913.11	276.91
9/29/2000 20:00	165.565	22.6001	169.465	16.6001	83.37678	8.1672492	284.26	27.85	2818.21	252.07
Date/Time	**In (ppm)**	**Out (ppm)**	**In Corr.**	**Out Corr.**	**Inlet (mg/m3)**	**Outlet (mg/m3)**	**Inlet Load (mg/min)**	**Outlet Load (mg/min)**	**Mass In (mg)**	**Mass Out (mg)**
9/29/2000 20:10	162.759	19.4632	166.659	13.4632	81.996228	6.6238944	279.38	22.57	2754.39	225.89
9/29/2000 20:20	158.165	19.4957	162.065	13.4957	79.73598	6.6398844	271.50	22.61	2649.99	225.88
9/29/2000 20:30	150.502	19.4795	154.402	13.4795	75.965784	6.631914	258.50	22.57	2464.56	216.49
9/29/2000 20:40	136.209	18.3905	140.109	12.3905	68.933628	6.096126	234.42	20.73	2284.00	209.14
9/29/2000 20:50	129.104	18.6181	133.004	12.6181	65.437968	6.2081052	222.38	21.10	2186.80	197.39
9/29/2000 21:00	124.756	17	128.656	11	63.298752	5.412	214.98	18.38	1965.37	175.39
9/29/2000 21:00	102.756	16	106.656	10	52.474752	4.92	178.10	16.70	1596.85	158.59
9/29/2000 21:00	80.756	15	84.656	9	41.650752	4.428	141.27	15.02	1245.48	141.80
9/29/2000 21:00	60.756	14	64.656	8	31.810752	3.936	107.83	13.34	1620.27	172.74
9/29/2000 21:10	124.756	18.6181	128.656	12.6181	63.298752	6.2081052	216.23	21.21	2162.29	212.07
10/2/2000 16:00	17.0641	1.27566	20.9641	0	10.3143372	0	35.38	0.00	224.74	12.39
10/2/2000 16:10	1.77092	7.46821	5.67092	1.46821	2.79009264	0.72235932	9.57	2.48	422.66	40.48
10/2/2000 16:20	40.5206	9.32923	44.4206	3.32923	21.8549352	1.63798116	74.96	5.62	826.88	64.62
10/2/2000 16:30	49.6768	10.3288	53.5768	4.3288	26.3597856	2.1297696	90.41	7.31	895.63	64.69
10/2/2000 16:40	48.6677	9.33736	52.5677	3.33736	25.8633084	1.64198112	88.71	5.63	878.46	56.32
10/2/2000 16:50	47.6421	9.33736	51.5421	3.33736	25.3587132	1.64198112	86.98	5.63	862.47	56.39
10/2/2000 17:00	46.7724	9.34548	50.6724	3.34548	24.9308208	1.64597616	85.51	5.65	846.27	49.19
10/2/2000 17:10	45.7223	8.48405	49.6223	2.48405	24.4141716	1.2221526	83.74	4.19	827.85	41.92
10/2/2000 17:20	44.5901	8.48405	48.4901	2.48405	23.8571292	1.2221526	81.83	4.19	817.68	49.12
10/2/2000 17:30	44.5162	9.33736	48.4162	3.33736	23.8207704	1.64198112	81.71	5.63	817.12	40.62
10/2/2000 17:40	44.5244	7.47634	48.4244	1.47634	23.8248048	0.72635928	81.72	2.49	808.40	24.91
10/2/2000 17:50	43.4824	7.47634	47.3824	1.47634	23.3121408	0.72635928	79.96	2.49	783.06	24.85

10/2/2000 18:00	41.5216	7.46821	45.4216	1.46821	22.3474272	0.72235932	76.65	2.48	757.76	14.90
10/2/2000 18:10	40.5124	6.29797	44.4124	0.29797	21.8509008	0.14660124	74.90	0.50	723.67	5.02
10/2/2000 18:20	37.5342	6.29797	41.4342	0.29797	20.3856264	0.14660124	69.83	0.50	679.52	2.51
10/2/2000 18:30	35.3272	5.29025	39.2272	0	19.2997824	0	66.07	0.00	635.50	0.00
10/2/2000 18:40	32.3572	5.29025	36.2572	0	17.8385424	0	61.03	0.00	584.77	0.00
10/2/2000 18:50	29.3461	5.29025	33.2461	0	16.3570812	0	55.92	0.00	533.69	0.00
10/2/2000 19:00	26.3269	4.4207	30.2269	0	14.8716348	0	50.81	0.00	490.53	0.00
10/2/2000 19:10	24.2512	4.43695	28.1512	0	13.8503904	0	47.29	0.00	447.64	0.00
10/2/2000 19:20	21.2565	4.4207	25.1565	0	12.376998	0	42.24	0.00	396.34	0.00
10/2/2000 19:30	18.1717	3.41298	22.0717	0	10.8592764	0	37.03	0.00	344.07	0.00
10/2/2000 19:40	15.054	3.40486	18.954	0	9.325368	0	31.78	0.00	310.08	0.00
					Inlet	**Outlet**	**Inlet Load**	**Outlet Load**		
Date/Time	**In (ppm)**	**Out (ppm)**	**In Corr.**	**Out Corr.**	**(mg/m3)**	**(mg/m3)**	**(mg/min)**	**(mg/min)**	**Mass In (mg)**	**Mass Out (mg)**
10/2/2000 19:50	14.1433	2.29962	18.0433	0	8.8773036	0	30.23	0.00	283.90	0.00
10/2/2000 20:00	11.9527	2.2915	15.8527	0	7.7995284	0	26.55	0.00	256.39	0.00
10/2/2000 20:10	10.8779	2.2915	14.7779	0	7.2707268	0	24.73	0.00	230.97	0.00
10/2/2000 20:20	8.93342	2.28337	12.8334	0	6.31404264	0	21.46	0.00	197.21	0.00
10/2/2000 20:30	6.85769	2.29962	10.7577	0	5.29278348	0	17.98	0.00	172.27	0.00
10/2/2000 20:40	5.9634	1.29191	9.8634	0	4.8527928	0	16.47	0.00	137.64	0.00
10/2/2000 20:50	2.72264	1.30004	6.62264	0	3.25833888	0	11.05	0.00	103.12	0.00
10/2/2000 21:00	1.83655	1.29191	5.73655	0	2.8223826	0	9.57	0.00	95.69	0.00

Total Mass In (m	**l Mass Out (mg)**
636107.28	**96340.37**
Total Removal Efficiency: 85%	

APPENDIX D

LABORATORY ANALYSIS OF REGENERATED CARBON, Air Force Research Laboratory, Tyndall Air Force Base, Florida.

ENVIROGEN

New Solutions to Hazardous Waste Problems

Princeton Research Center

4100 Quakerbridge Road
Lawrenceville, New Jersey 08648
Tel: 609/936/9300
Fax: 609/936-9221

Volatile Organic Compound Data Summaries

Prepared For
Tyndall AFB
Biofilter

Lab ID
4371

Samples Received
24-Oct-00

Reported
5-Dec-00

NJDEP Certified Lab 11001

4371

ENVIROGEN - Chain-of Custody

Page of

Client, Contact & Project Name: Tyndall AFB Biofilter

Phone: ( )

Project No. 78204

Envirogen Contact: Paul Togna / Todd Webster

EPA ID No:

Phone: ( )

Turnaround: Normal / Rapid (circled)

Deliverable:
- [x] No QA/QC rec
- [ ] reduced QA/QC
- [ ] Full QA/QC
- [ ] NJ ED

Sampler: (Print/Sign) Charles Allritton

Sampling Method: Grab

ANALYSIS — Request analysis by analyte and method number

Laboratory ID No.	Sample ID Location	Date	Time	Sample Matrix	Number Bottles	Volume Bottles	Preservative	8260 + L	Comment
1	Sample #1 - Absorber	10/12/00		GAC	1	1 L	None	✓	Cold MeOH Extraction
2	Sample #2 - Reactor	10/12/00		GAC	1	1 L	None	✓	Cold MeOH Extraction

Relinquished by : (Signature)	Date	Time	Received by : (Signature)	Date	Time
[signature]	10/24/00	12:40			

SAMPLE COLLECTOR

ENVIROGEN
4100 Quakerbridge Road
Lawrenceville, NJ 08648
609-936-9300

Method of Shipment:

Shipped by: (Signature)

Received for Laboratory by: (Signature) [signature] 10-24-00 13:L

2.0 Summary Sample Results

For Ronald Unterman, Ph.D — Date: 12/8/00

Ronald Unterman, Ph.D

Laboratory Director

Tyndall AFB

Envirogen Analytical and Treatability Laboratories Internal Chain of Custody

Lab ID 4371-2

Date Received 10/24/00

Sample ID	Parameter	Bottle Type	Perservative	Date/Time Removed	Relinquishing Custodian Initials	Receiving Analyst Initials	Date/Time Returned	Receiving Custodian Initials	Relinquishing Analyst Initials
1	8260 + L	(1) 1L	–	11-20-00 12:0	PD	AS	11-20-00 15L	PD	AS
2	↓	↓	↓	11-20-00 12:0	↓	AS	11-20-00 15L	↓	AS

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

Sample

4371-1

Lab Name: ENVIROGEN Analyst: AS

NJ DEP#: 11001 Calib date 11/17/00 GC/MS: Inst #2 Client: NA

Matrix: (soil/water) SOIL Lab Sample ID: 4371-1 0.02ml

Sample wt/vol: 5.0 (g/ml) G Lab File ID: S2003.D

Level: (low/med) MED Date Received: 10/24/00

% Moisture: not dec. 0 Date Analyzed: 11/20/00

GC Column: rt502.2 ID: 0.25 (mm) Dilution Factor: ~~1.0~~ 2500 PR

Soil Extract Volume: 25 (uL) Soil Aliquot Volume: 0.02 (uL)

CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG

CAS NO.	COMPOUND	UG/KG	Q
74-75-8	Dichlorodifluoromethane	25000	U
74-87-3	Chloromethane	12000	U
75-01-4	Vinyl chloride	12000	U
74-83-9	Bromomethane	12000	U
75-00-3	Chloroethane	12000	U
75-69-4	Trichlorofluoromethane	25000	U
75-35-4	1,1-Dichloroethene	12000	U
75-09-2	Methylene chloride	12000	U
156-60-5	trans-1,2-Dichloroethene	12000	U
75-34-3	1,1-Dichloroethane	12000	U
594-20-7	2,2-Dichloropropane	12000	U
156-60-5	cis-1,2-Dichloroethene	12000	U
74-97-5	Bromochloromethane	12000	U
67-66-3	Chloroform	12000	U
71-55-6	1,1,1-Trichloroethane	12000	U
56-23-5	Carbon tetrachloride	12000	U
563-58-6	1,1-Dichloropropene	12000	U
71-43-2	Benzene	22000	
107-06-2	1,2-Dichloroethane	12000	U
79-01-6	Trichloroethene	12000	U
78-87-5	1,2-Dichloropropane	12000	U
74-95-3	Dibromomethane	12000	U
75-27-4	Bromodichloromethane	12000	U
10061-01	cis-1,3-Dichloropropene	12000	U
108-88-3	Toluene	78000	
10061-01	trans-1,3-Dichloropropene	12000	U
79-00-5	1,1,2-Trichloroethane	12000	U
127-18-4	Tetrachloroethene	12000	U
142-28-9	1,3-Dichloropropane	12000	U
124-48-1	Dibromochloromethane	12000	U
106-93-4	1,2-Dibromoethane	12000	U
108-90-7	Chlorobenzene	12000	U
630-2-6	1,1,1,2-Tetrachloroethane	12000	U
100-41-4	Ethylbenzene	12000	U
1330-20-7	Xylene (para & meta)	3100	J
1330-20-7	Xylene (Ortho)	12000	U
100-42-5	Styrene	12000	U
75-25-2	Bromoform	12000	U
98-82-8	Isopropylbenzene	12000	U

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

Sample: **4371-1**

Lab Name: ENVIROGEN   Analyst: AS

NJ DEP#: 11001   Calib date 11/17/00   GC/MS: Inst #2   Client: NA

Matrix: (soil/water) SOIL   Lab Sample ID: 4371-1 0.02ml

Sample wt/vol: 5.0 (g/ml) G   Lab File ID: S2003.D

Level: (low/med) MED   Date Received: 10/24/00

% Moisture: not dec. 0   Date Analyzed: 11/20/00

GC Column: rt502.2 ID: 0.25 (mm)   Dilution Factor: ~~1.0~~ 2500 RR

Soil Extract Volume: 25 (uL)   Soil Aliquot Volume: 0.02 (uL)

CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG

CAS NO.	COMPOUND	UG/KG	Q
108-86-1	Bromobenzene	12000	U
79-34-5	1,1,2,2-Tetrachloroethane	12000	U
96-18-4	1,2,3-Trichloropropane	12000	U
106-65-1	n-Propylbenzene	25000	U
95-49-8	2-Chlorotoluene	25000	U
106-43-4	4-Chlorotoluene	25000	U
108-67-8	1,3,5-Trimethylbenzene	12000	U
98-06-6	tert-Butylbenzene	12000	U
95-63-6	1,2,4-Trimethylbenzene	12000	U
135-98-8	sec-Butylbenzene	25000	U
541-73-1	1,3-Dichlorobenzene	12000	U
99-87-6	4-Isopropyltoluene	25000	U
106-46-7	1,4-Dichlorobenzene	12000	U
95-50-1	1,2-Dichlorobenzene	12000	U
14-51-8	n-Butylbenzene	25000	U
96-12-8	1,2-Dibromo-3-chloropropane	12000	U
120-82-1	1,2,4-Trichlorobenzene	12000	U
87-68-3	Hexachlorobutadiene	25000	U
91-20-3	Naphthalene	12000	U
87-61-6	1,2,3-Trichlorobenzene	12000	U
1634-04-4	MTBE	12000	U
67-64-1	Acetone	18000	J
75-15-0	Carbon disulfide	12000	U
78-93-3	2-Butanone (MEK)	2300000	E
109-99-9	Tetrahydrofuran (THF)	25000	U
591-78-6	2-Hexanone	25000	U
110-75-8	2-Chloroethyl vinyl ether	25000	U

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

Sample

4371-1

Lab Name: ENVIROGEN   Analyst: AS

NJ DEP#: 11001   Calib date 11/17/00   GC/MS: Inst #2   Client: NA

Matrix: (soil/water) SOIL   Lab Sample ID: 4371-1 0.02ml

Sample wt/vol: 5.0 (g/ml) G   Lab File ID: S2003.D

Level: (low/med) MED   Date Received: 10/24/00

% Moisture: not dec. 0   Date Analyzed: 11/20/00

GC Column: rt502.2 ID: 0.25 (mm)   Dilution Factor: ~~10~~ 2500

Soil Extract Volume: 25 (uL)   Soil Aliquot Volume: 0.02 (uL)

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/KG

Number TICs found: 12

CAS NO.	COMPOUND NAME	RT	EST. CONC.	Q
1. 000109-66-0	Pentane	3.19	9700	JN
2. 053778-43-1	substituded cyclopropane or methyl pentene	4.49	9800	JN
3. 000079-20-9	Acetic acid, methyl ester	4.64	17000	JN
4. 000592-41-6	1-Hexene	5.57	8500	JN
5. 000078-92-2	2-Butanol	7.01	6600	JN
6. 000141-78-6	Ethyl Acetate	7.84	9200	JN
7. 000107-87-9	2-Pentanone	10.81	77000	JN
8. 000123-86-4	Acetic acid, butyl ester	14.52	81000	JN
9. 007789-99-3	1-Pentanol, 2-methyl-, acetate	18.34	22000	JN
10. 000142-92-7	Acetic acid, hexyl ester	18.56	19000	JN
11. 004806-33-1	2-Butanol, 2,3-dimethyl-, acetate	18.71	39000	JN
12. 000142-92-7	Acetic acid, hexyl ester	19.36	15000	JN

```
Data File : C:\HPCHEM\1\DATA\112000\S2003.D          Vial: 5
Acq On    : 20 Nov 2000   4:53 pm                Operator: TS
Sample    : 4371-1 0.02mlex(5-25ml)              Inst    : GC/MS Ins
Misc      :                                      Multiplr: 1.00
MS Integration Params: ODD.P
Quant Time: Dec  5 10:36 2000          Quant Results File: 5971VOA.RES

Method        : C:\HPCHEM\1\METHODS\5971VOA.M (RTE Integrator)
Title         : EPA Method 8260A
Last Update   : Fri Nov 17 12:04:52 2000
Response via  : Initial Calibration
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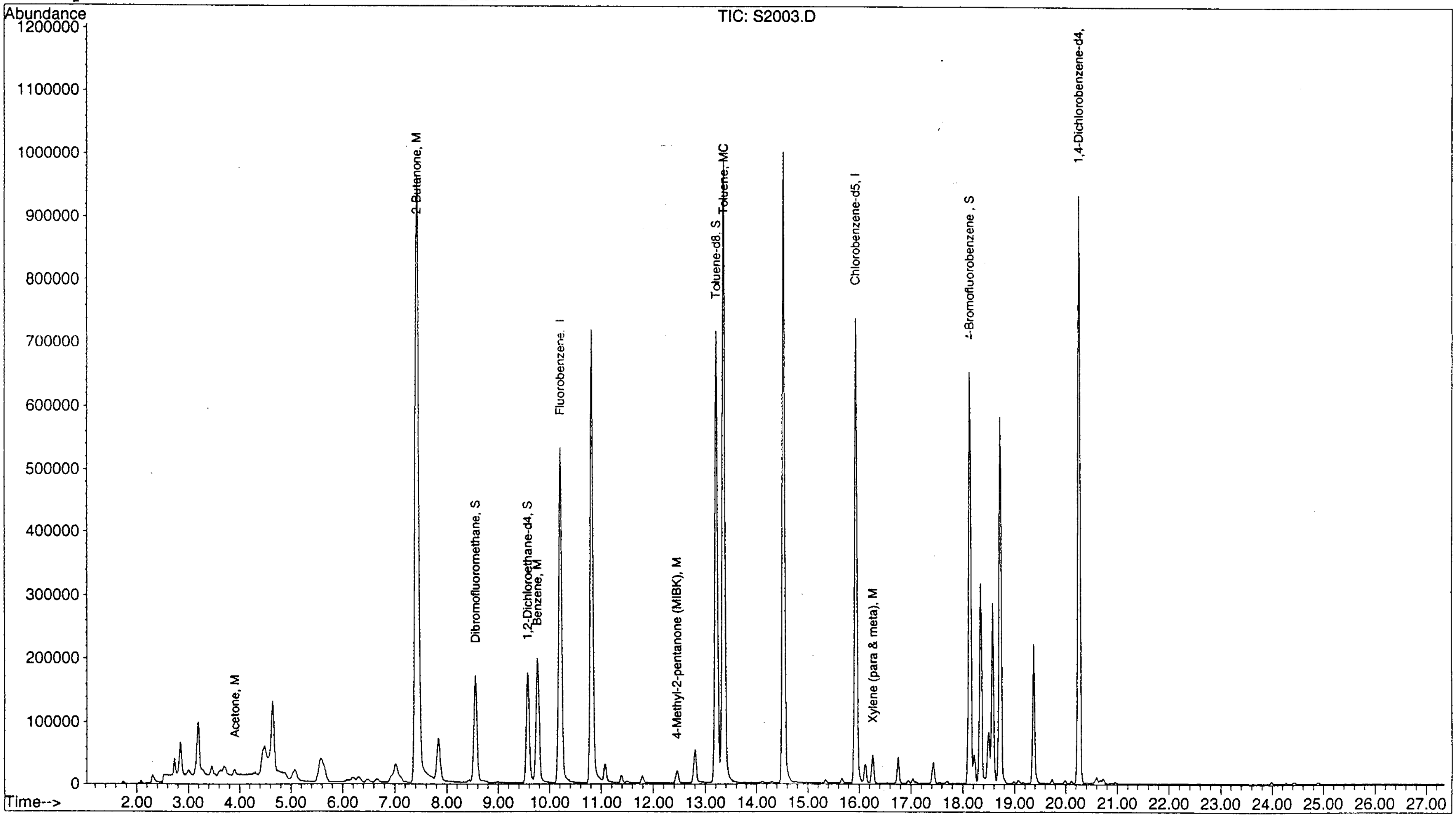


1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

Sample

4371-1

Lab Name: ENVIROGEN Analyst: AS

NJ DEP#: 11001 Calib date 11/17/00 GC/MS: Inst #2 Client: NA

Matrix: (soil/water) SOIL Lab Sample ID: 4371-1 0.001ml(5g-

Sample wt/vol: 5.0 (g/ml) G Lab File ID: S2003.D

Level: (low/med) MED Date Received: 10/24/00

% Moisture: not dec. 0 Date Analyzed: 11/21/00

GC Column: rt502.2 ID: 0.25 (mm) Dilution Factor: ~~1.0~~ 50,000 pR

Soil Extract Volume: 25 (uL) Soil Aliquot Volume: 0.001 (uL)

CONCENTRATION UNITS:

CAS NO.	COMPOUND	(ug/L or ug/Kg) UG/KG	Q
74-75-8	Dichlorodifluoromethane	500000	U
74-87-3	Chloromethane	250000	U
75-01-4	Vinyl chloride	250000	U
74-83-9	Bromomethane	250000	U
75-00-3	Chloroethane	250000	U
75-69-4	Trichlorofluoromethane	500000	U
75-35-4	1,1-Dichloroethene	250000	U
75-09-2	Methylene chloride	250000	U
156-60-5	trans-1,2-Dichloroethene	250000	U
75-34-3	1,1-Dichloroethane	250000	U
594-20-7	2,2-Dichloropropane	250000	U
156-60-5	cis-1,2-Dichloroethene	250000	U
74-97-5	Bromochloromethane	250000	U
67-66-3	Chloroform	250000	U
71-55-6	1,1,1-Trichloroethane	250000	U
56-23-5	Carbon tetrachloride	250000	U
563-58-6	1,1-Dichloropropene	250000	U
71-43-2	Benzene	250000	U
107-06-2	1,2-Dichloroethane	250000	U
79-01-6	Trichloroethene	250000	U
78-87-5	1,2-Dichloropropane	250000	U
74-95-3	Dibromomethane	250000	U
75-27-4	Bromodichloromethane	250000	U
10061-01	cis-1,3-Dichloropropene	250000	U
108-88-3	Toluene	84000	J
10061-01	trans-1,3-Dichloropropene	250000	U
79-00-5	1,1,2-Trichloroethane	250000	U
127-18-4	Tetrachloroethene	250000	U
142-28-9	1,3-Dichloropropane	250000	U
124-48-1	Dibromochloromethane	250000	U
106-93-4	1,2-Dibromoethane	250000	U
108-90-7	Chlorobenzene	250000	U
630-2-6	1,1,1,2-Tetrachloroethane	250000	U
100-41-4	Ethylbenzene	250000	U
1330-20-7	Xylene (para & meta)	250000	U
1330-20-7	Xylene (Ortho)	250000	U
100-42-5	Styrene	250000	U
75-25-2	Bromoform	250000	U
98-82-8	Isopropylbenzene	250000	U

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

Sample: **4371-1**

Lab Name: ENVIROGEN Analyst: AS

NJ DEP#: 11001 Calib date 11/17/00 GC/MS: Inst #2 Client: NA

Matrix: (soil/water) SOIL Lab Sample ID: 4371-1 0.001ml(5g-

Sample wt/vol: 5.0 (g/ml) G Lab File ID: S2003.D

Level: (low/med) MED Date Received: 10/24/00

% Moisture: not dec. 0 Date Analyzed: 11/21/00

GC Column: rt502.2 ID: 0.25 (mm) Dilution Factor: ~~1.0~~ 50,000 PR

Soil Extract Volume: 25 (uL) Soil Aliquot Volume: 0.001 (uL)

CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG

CAS NO.	COMPOUND	UG/KG	Q
108-86-1	Bromobenzene	250000	U
79-34-5	1,1,2,2-Tetrachloroethane	250000	U
96-18-4	1,2,3-Trichloropropane	250000	U
106-65-1	n-Propylbenzene	500000	U
95-49-8	2-Chlorotoluene	500000	U
106-43-4	4-Chlorotoluene	500000	U
108-67-8	1,3,5-Trimethylbenzene	250000	U
98-06-6	tert-Butylbenzene	250000	U
95-63-6	1,2,4-Trimethylbenzene	250000	U
135-98-8	sec-Butylbenzene	500000	U
541-73-1	1,3-Dichlorobenzene	250000	U
99-87-6	4-Isopropyltoluene	500000	U
106-46-7	1,4-Dichlorobenzene	250000	U
95-50-1	1,2-Dichlorobenzene	250000	U
14-51-8	n-Butylbenzene	500000	U
96-12-8	1,2-Dibromo-3-chloropropane	250000	U
120-82-1	1,2,4-Trichlorobenzene	250000	U
87-68-3	Hexachlorobutadiene	500000	U
91-20-3	Naphthalene	250000	U
87-61-6	1,2,3-Trichlorobenzene	250000	U
1634-04-4	MTBE	250000	U
67-64-1	Acetone	300000	J
75-15-0	Carbon disulfide	250000	U
78-93-3	2-Butanone (MEK)	2100000	
109-99-9	Tetrahydrofuran (THF)	500000	U
591-78-6	2-Hexanone	500000	U
110-75-8	2-Chloroethyl vinyl ether	500000	U

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET

TENTATIVELY IDENTIFIED COMPOUNDS

Sample

4371-1

Lab Name: ENVIROGEN Analyst: AS

NJ DEP#: 11001 Calib date 11/17/00 GC/MS: Inst #2 Client: NA

Matrix: (soil/water) SOIL Lab Sample ID: 4371-1 0.001ml(5g-

Sample wt/vol: 5.0 (g/ml) G Lab File ID: S2003.D

Level: (low/med) MED Date Received: 10/24/00

% Moisture: not dec. 0 Date Analyzed: 11/21/00

GC Column: rt502.2 ID: 0.25 (mm) Dilution Factor: ~~1.0~~ 50,000 PL

Soil Extract Volume: 25 (uL) Soil Aliquot Volume: 0.001 (uL)

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/KG

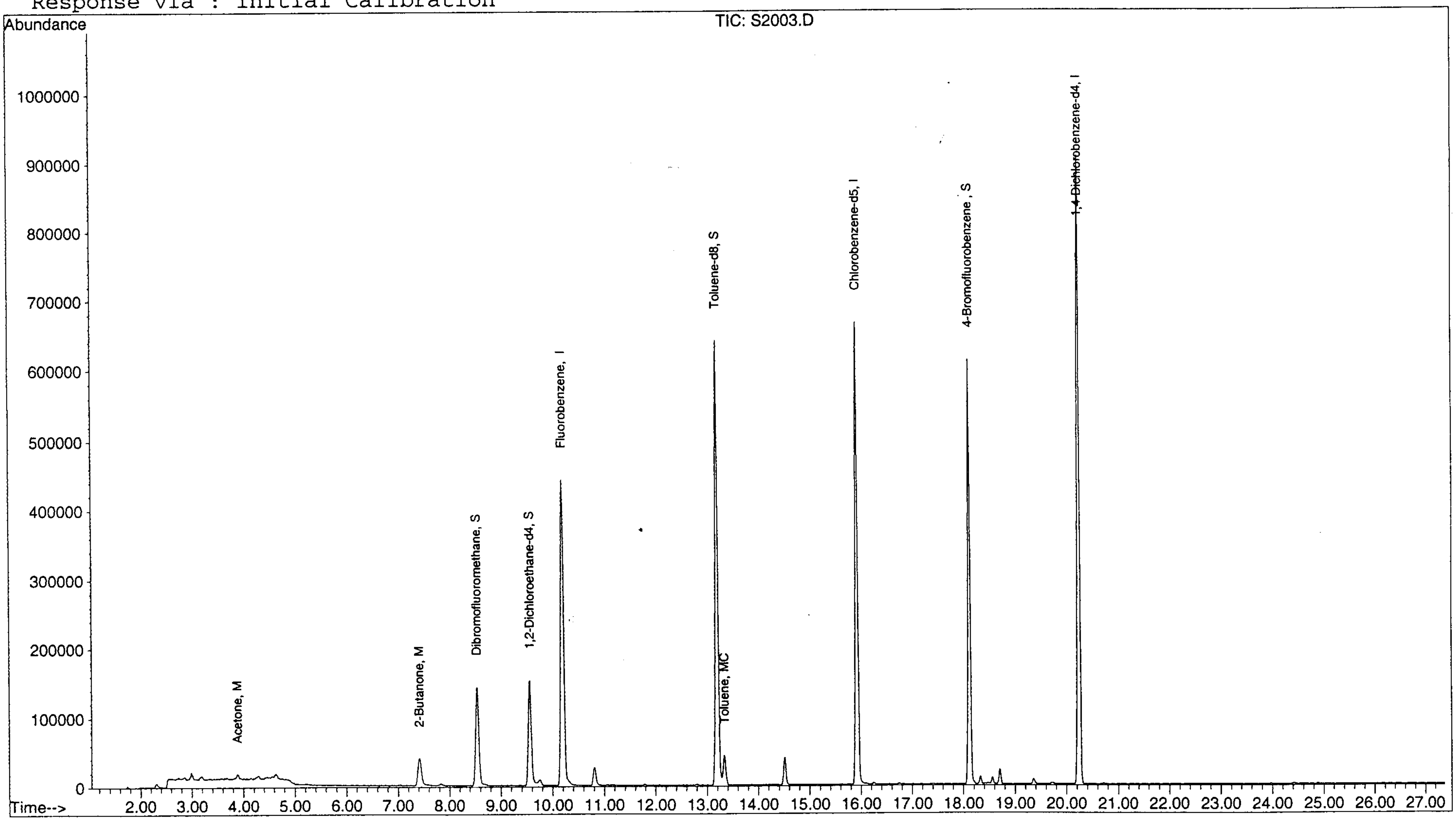
Number TICs found: 2

CAS NO.	COMPOUND NAME	RT	EST. CONC.	Q
1. 000107-87-9	2-Pentanone	10.80	68000	JN
2. 000123-86-4	Acetic acid, butyl ester	14.51	74000	JN

Data File : C:\HPCHEM\1\DATA\112100\S2003.D
Acq On : 21 Nov 2000 6:13 pm
Sample : 4371-1 0.001ml(5g-25ext)
Misc :
MS Integration Params: ODD.P
Quant Time: Dec 5 11:04 2000

Vial: 6
Operator: TS
Inst : GC/MS Ins
Multiplr: 1.00
Quant Results File: 5971VOA.RES

Method : C:\HPCHEM\1\METHODS\5971VOA.M (RTE Integrator)
Title : EPA Method 8260A
Last Update : Fri Nov 17 12:04:52 2000
Response via : Initial Calibration



1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

Sample

4371-1

Lab Name: ENVIROGEN Analyst: AS

NJ DEP#: 11001 Calib date 11/17/00 GC/MS: Inst #2 Client: NA

Matrix: (soil/water) SOIL Lab Sample ID: 4371-1 0.002ml

Sample wt/vol: 5.0 (g/ml) G Lab File ID: S2009.D

Level: (low/med) MED Date Received: 10/24/00

% Moisture: not dec. 0 Date Analyzed: 11/22/00

GC Column: rt502.2 ID: 0.25 (mm) Dilution Factor: ~~10~~ 25,000 PR

Soil Extract Volume: 25 (uL) Soil Aliquot Volume: 0.002 (uL)

CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG

CAS NO.	COMPOUND	UG/KG	Q
74-75-8	Dichlorodifluoromethane	250000	U
74-87-3	Chloromethane	120000	U
75-01-4	Vinyl chloride	120000	U
74-83-9	Bromomethane	120000	U
75-00-3	Chloroethane	120000	U
75-69-4	Trichlorofluoromethane	250000	U
75-35-4	1,1-Dichloroethene	120000	U
75-09-2	Methylene chloride	120000	U
156-60-5	trans-1,2-Dichloroethene	120000	U
75-34-3	1,1-Dichloroethane	120000	U
594-20-7	2,2-Dichloropropane	120000	U
156-60-5	cis-1,2-Dichloroethene	120000	U
74-97-5	Bromochloromethane	120000	U
67-66-3	Chloroform	120000	U
71-55-6	1,1,1-Trichloroethane	120000	U
56-23-5	Carbon tetrachloride	120000	U
563-58-6	1,1-Dichloropropene	120000	U
71-43-2	Benzene	120000	U
107-06-2	1,2-Dichloroethane	27000	J
79-01-6	Trichloroethene	120000	U
78-87-5	1,2-Dichloropropane	120000	U
74-95-3	Dibromomethane	120000	U
75-27-4	Bromodichloromethane	120000	U
10061-01	cis-1,3-Dichloropropene	120000	U
108-88-3	Toluene	56000	J
10061-01	trans-1,3-Dichloropropene	120000	U
79-00-5	1,1,2-Trichloroethane	120000	U
127-18-4	Tetrachloroethene	40000	J
142-28-9	1,3-Dichloropropane	120000	U
124-48-1	Dibromochloromethane	120000	U
106-93-4	1,2-Dibromoethane	120000	U
108-90-7	Chlorobenzene	120000	U
630-2-6	1,1,1,2-Tetrachloroethane	120000	U
100-41-4	Ethylbenzene	120000	U
1330-20-7	Xylene (para & meta)	120000	U
1330-20-7	Xylene (Ortho)	120000	U
100-42-5	Styrene	120000	U
75-25-2	Bromoform	120000	U
98-82-8	Isopropylbenzene	120000	U

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

Sample: **4371-1**

Lab Name: ENVIROGEN Analyst: AS

NJ DEP#: 11001 Calib date 11/17/00 GC/MS: Inst #2 Client: NA

Matrix: (soil/water) SOIL Lab Sample ID: 4371-1 0.002ml

Sample wt/vol: 5.0 (g/ml) G Lab File ID: S2009.D

Level: (low/med) MED Date Received: 10/24/00

% Moisture: not dec. 0 Date Analyzed: 11/22/00

GC Column: rt502.2 ID: 0.25 (mm) Dilution Factor: ~~1.0~~ 25,000

Soil Extract Volume: 25 (uL) Soil Aliquot Volume: 0.002 (uL)

CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG

CAS NO.	COMPOUND	UG/KG	Q
108-86-1	Bromobenzene	120000	U
79-34-5	1,1,2,2-Tetrachloroethane	120000	U
96-18-4	1,2,3-Trichloropropane	120000	U
106-65-1	n-Propylbenzene	250000	U
95-49-8	2-Chlorotoluene	250000	U
106-43-4	4-Chlorotoluene	250000	U
108-67-8	1,3,5-Trimethylbenzene	120000	U
98-06-6	tert-Butylbenzene	120000	U
95-63-6	1,2,4-Trimethylbenzene	120000	U
135-98-8	sec-Butylbenzene	250000	U
541-73-1	1,3-Dichlorobenzene	120000	U
99-87-6	4-Isopropyltoluene	250000	U
106-46-7	1,4-Dichlorobenzene	120000	U
95-50-1	1,2-Dichlorobenzene	120000	U
14-51-8	n-Butylbenzene	250000	U
96-12-8	1,2-Dibromo-3-chloropropane	120000	U
120-82-1	1,2,4-Trichlorobenzene	120000	U
87-68-3	Hexachlorobutadiene	250000	U
91-20-3	Naphthalene	120000	U
87-61-6	1,2,3-Trichlorobenzene	120000	U
1634-04-4	MTBE	120000	U
67-64-1	Acetone	200000	J
75-15-0	Carbon disulfide	120000	U
78-93-3	2-Butanone (MEK)	2300000	
109-99-9	Tetrahydrofuran (THF)	250000	U
591-78-6	2-Hexanone	250000	U
110-75-8	2-Chloroethyl vinyl ether	250000	U

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET

TENTATIVELY IDENTIFIED COMPOUNDS

Sample

4371-1

Lab Name: ENVIROGEN Analyst: AS

NJ DEP#: 11001 Calib date 11/17/00 GC/MS: Inst #2 Client: NA

Matrix: (soil/water) SOIL Lab Sample ID: 4371-1 0.002ml

Sample wt/vol: 5.0 (g/ml) G Lab File ID: S2009.D

Level: (low/med) MED Date Received: 10/24/00

% Moisture: not dec. 0 Date Analyzed: 11/22/00

GC Column: rt502.2 ID: 0.25 (mm) Dilution Factor: ~~1.0~~ 25,000 PR

Soil Extract Volume: 25 (uL) Soil Aliquot Volume: 0.002 (uL)

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/KG

Number TICs found: 1

CAS NO.	COMPOUND NAME	RT	EST. CONC.	Q
1. 000107-87-9	2-Pentanone	10.78	46000	JN

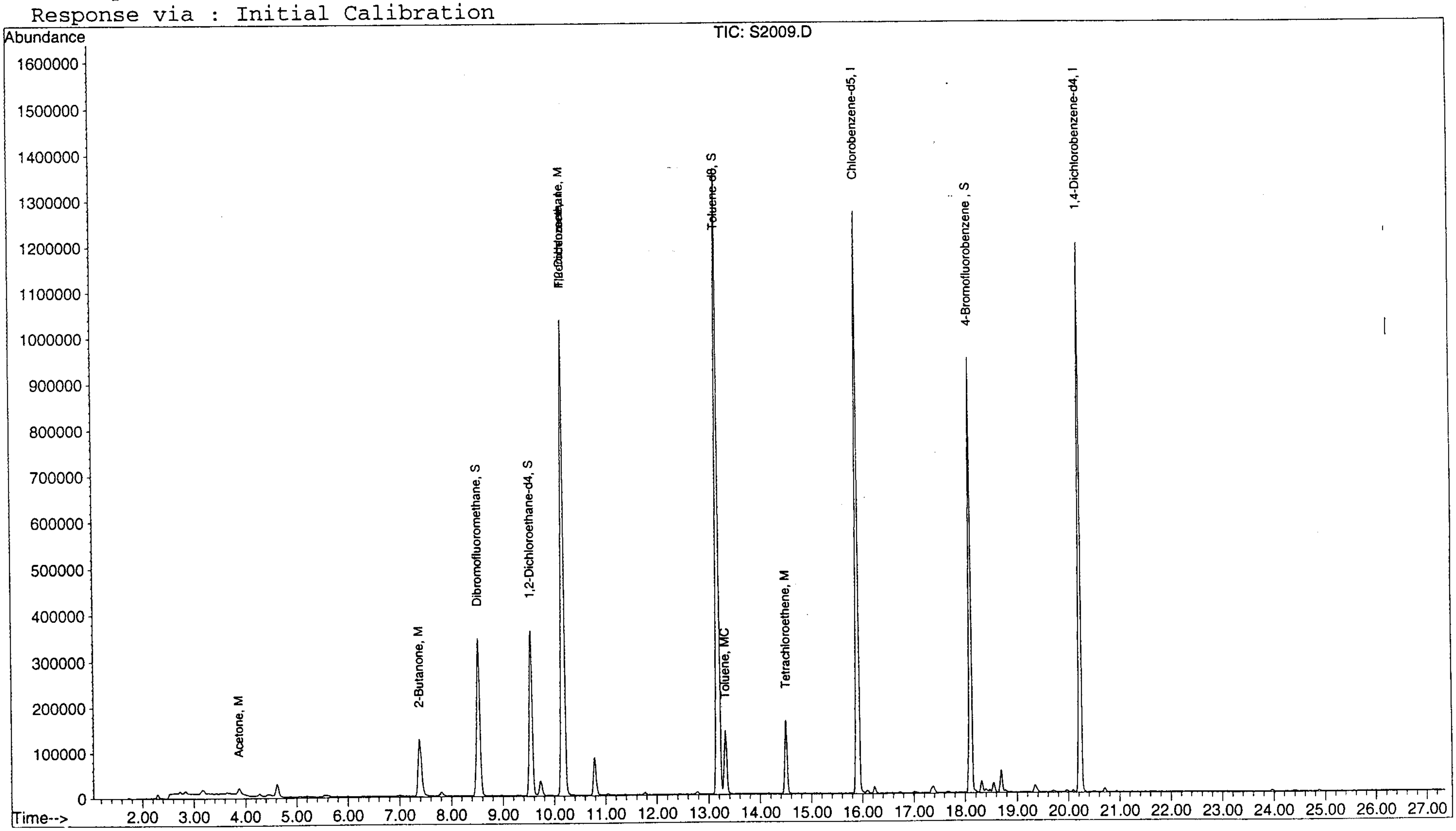
Quantitation Report

Data File : C:\HPCHEM\1\DATA\112200\S2009.D
Acq On : 22 Nov 2000 8:54 pm
Sample : 4371-1 0.002ml
Misc :
MS Integration Params: ODD.P
Quant Time: Dec 5 11:19 2000

Vial: 11
Operator: TS
Inst : GC/MS Ins
Multiplr: 1.00

Quant Results File: 5971VOA.RES

Method : C:\HPCHEM\1\METHODS\5971VOA.M (RTE Integrator)
Title : EPA Method 8260A
Last Update : Fri Nov 17 12:04:52 2000
Response via : Initial Calibration



1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

Sample

4371-2

Lab Name: ENVIROGEN Analyst: AS

NJ DEP#: 11001 Calib date 11/17/00 GC/MS: Inst #2 Client: NA

Matrix: (soil/water) SOIL Lab Sample ID: 4371-2 0.02ml

Sample wt/vol: 5.0 (g/ml) G Lab File ID: S2004.D

Level: (low/med) MED Date Received: 10/24/00

% Moisture: not dec. 0 Date Analyzed: 11/20/00

GC Column: rt502.2 ID: 0.25 (mm) Dilution Factor: ~~1.0~~ 2500 PR

Soil Extract Volume: 25 (uL) Soil Aliquot Volume: 0.02 (uL)

CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG

CAS NO.	COMPOUND	UG/KG	Q
74-75-8	Dichlorodifluoromethane	25000	U
74-87-3	Chloromethane	12000	U
75-01-4	Vinyl chloride	12000	U
74-83-9	Bromomethane	12000	U
75-00-3	Chloroethane	12000	U
75-69-4	Trichlorofluoromethane	25000	U
75-35-4	1,1-Dichloroethene	12000	U
75-09-2	Methylene chloride	12000	U
156-60-5	trans-1,2-Dichloroethene	12000	U
75-34-3	1,1-Dichloroethane	12000	U
594-20-7	2,2-Dichloropropane	12000	U
156-60-5	cis-1,2-Dichloroethene	12000	U
74-97-5	Bromochloromethane	12000	U
67-66-3	Chloroform	12000	U
71-55-6	1,1,1-Trichloroethane	12000	U
56-23-5	Carbon tetrachloride	12000	U
563-58-6	1,1-Dichloropropene	12000	U
71-43-2	Benzene	5800	J
107-06-2	1,2-Dichloroethane	12000	U
79-01-6	Trichloroethene	12000	U
78-87-5	1,2-Dichloropropane	12000	U
74-95-3	Dibromomethane	12000	U
75-27-4	Bromodichloromethane	12000	U
10061-01	cis-1,3-Dichloropropene	12000	U
108-88-3	Toluene	10000	J
10061-01	trans-1,3-Dichloropropene	12000	U
79-00-5	1,1,2-Trichloroethane	12000	U
127-18-4	Tetrachloroethene	12000	U
142-28-9	1,3-Dichloropropane	12000	U
124-48-1	Dibromochloromethane	12000	U
106-93-4	1,2-Dibromoethane	12000	U
108-90-7	Chlorobenzene	12000	U
630-2-6	1,1,1,2-Tetrachloroethane	12000	U
100-41-4	Ethylbenzene	12000	U
1330-20-7	Xylene (para & meta)	12000	U
1330-20-7	Xylene (Ortho)	12000	U
100-42-5	Styrene	12000	U
75-25-2	Bromoform	12000	U
98-82-8	Isopropylbenzene	12000	U

1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

Sample

4371-2

Lab Name: ENVIROGEN Analyst: AS

NJ DEP#: 11001 Calib date 11/17/00 GC/MS: Inst #2 Client: NA

Matrix: (soil/water) SOIL Lab Sample ID: 4371-2 0.02ml

Sample wt/vol: 5.0 (g/ml) G Lab File ID: S2004.D

Level: (low/med) MED Date Received: 10/24/00

% Moisture: not dec. 0 Date Analyzed: 11/20/00

GC Column: rt502.2 ID: 0.25 (mm) Dilution Factor: ~~1.0~~ 2500 PR

Soil Extract Volume: 25 (uL) Soil Aliquot Volume: 0.02 (uL)

CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG

CAS NO.	COMPOUND	UG/KG	Q
108-86-1	Bromobenzene	12000	U
79-34-5	1,1,2,2-Tetrachloroethane	12000	U
96-18-4	1,2,3-Trichloropropane	12000	U
106-65-1	n-Propylbenzene	25000	U
95-49-8	2-Chlorotoluene	25000	U
106-43-4	4-Chlorotoluene	25000	U
108-67-8	1,3,5-Trimethylbenzene	12000	U
98-06-6	tert-Butylbenzene	12000	U
95-63-6	1,2,4-Trimethylbenzene	12000	U
135-98-8	sec-Butylbenzene	25000	U
541-73-1	1,3-Dichlorobenzene	12000	U
99-87-6	4-Isopropyltoluene	25000	U
106-46-7	1,4-Dichlorobenzene	12000	U
95-50-1	1,2-Dichlorobenzene	12000	U
14-51-8	n-Butylbenzene	25000	U
96-12-8	1,2-Dibromo-3-chloropropane	12000	U
120-82-1	1,2,4-Trichlorobenzene	12000	U
87-68-3	Hexachlorobutadiene	25000	U
91-20-3	Naphthalene	12000	U
87-61-6	1,2,3-Trichlorobenzene	12000	U
1634-04-4	MTBE	12000	U
67-64-1	Acetone	68000	
75-15-0	Carbon disulfide	12000	U
78-93-3	2-Butanone (MEK)	160000	
109-99-9	Tetrahydrofuran (THF)	25000	U
591-78-6	2-Hexanone	25000	U
110-75-8	2-Chloroethyl vinyl ether	25000	U

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET

TENTATIVELY IDENTIFIED COMPOUNDS

Sample

4371-2

Lab Name: ENVIROGEN Analyst: AS

NJ DEP#: 11001 Calib date 11/17/00 GC/MS: Inst #2 Client: NA

Matrix: (soil/water) SOIL Lab Sample ID: 4371-2 0.02ml

Sample wt/vol: 5.0 (g/ml) G Lab File ID: S2004.D

Level: (low/med) MED Date Received: 10/24/00

% Moisture: not dec. 0 Date Analyzed: 11/20/00

GC Column: rt502.2 ID: 0.25 (mm) Dilution Factor: 1.0

Soil Extract Volume: 25 (uL) Soil Aliquot Volume: 0.02 (uL)

CONCENTRATION UNITS:

(ug/L or ug/Kg) UG/KG

Number TICs found: 1

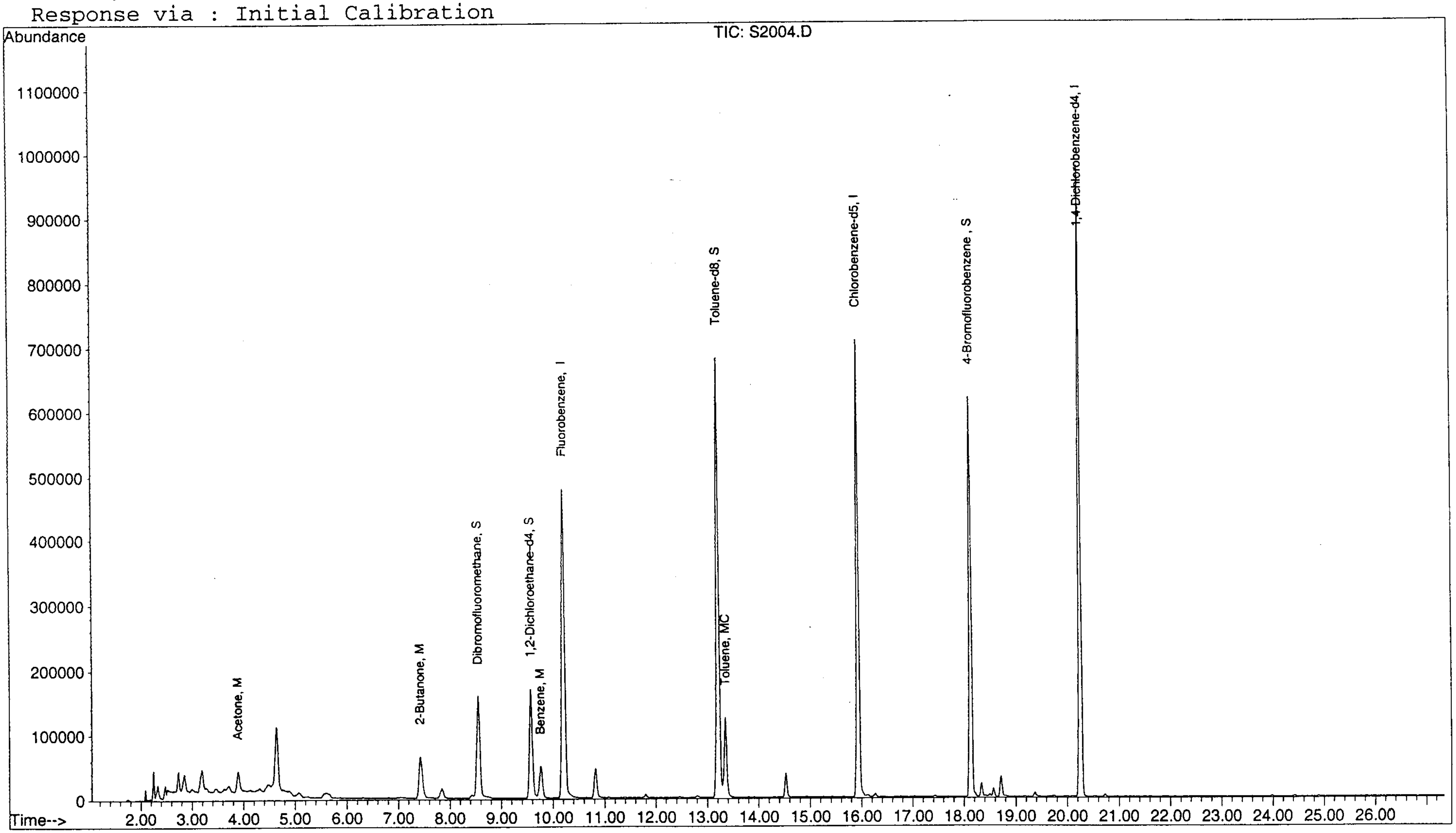
CAS NO.	COMPOUND NAME	RT	EST. CONC.	Q
1. 000079-20-9	Acetic acid, methyl ester	4.64	16000	JN

Data File : C:\HPCHEM\1\DATA\112000\S2004.D
Acq On : 20 Nov 2000 5:27 pm
Sample : 4371-2 0.02mlex(5-25ml)
Misc :
MS Integration Params: ODD.P
Quant Time: Dec 5 10:56 2000

Vial: 6
Operator: TS
Inst : GC/MS Ins
Multiplr: 1.00

Quant Results File: 5971VOA.RES

Method : C:\HPCHEM\1\METHODS\5971VOA.M (RTE Integrator)
Title : EPA Method 8260A
Last Update : Fri Nov 17 12:04:52 2000
Response via : Initial Calibration



1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

Sample

4371-2

Lab Name: ENVIROGEN Analyst: AS

NJ DEP#: 11001 Calib date 11/17/00 GC/MS: Inst #2 Client: NA

Matrix: (soil/water) SOIL Lab Sample ID: 4371-2 0.010ml

Sample wt/vol: 5.0 (g/ml) G Lab File ID: S2004.D

Level: (low/med) MED Date Received: 10/24/00

% Moisture: not dec. 0 Date Analyzed: 11/21/00

GC Column: rt502.2 ID: 0.25 (mm) Dilution Factor: ~~1.0~~ 5,000 RR

Soil Extract Volume: 25 (uL) Soil Aliquot Volume: 0.01 (uL)

CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG

CAS NO.	COMPOUND	UG/KG	Q
74-75-8	Dichlorodifluoromethane	50000	U
74-87-3	Chloromethane	25000	U
75-01-4	Vinyl chloride	25000	U
74-83-9	Bromomethane	25000	U
75-00-3	Chloroethane	25000	U
75-69-4	Trichlorofluoromethane	50000	U
75-35-4	1,1-Dichloroethene	25000	U
75-09-2	Methylene chloride	25000	U
156-60-5	trans-1,2-Dichloroethene	25000	U
75-34-3	1,1-Dichloroethane	25000	U
594-20-7	2,2-Dichloropropane	25000	U
156-60-5	cis-1,2-Dichloroethene	25000	U
74-97-5	Bromochloromethane	25000	U
67-66-3	Chloroform	25000	U
71-55-6	1,1,1-Trichloroethane	25000	U
56-23-5	Carbon tetrachloride	25000	U
563-58-6	1,1-Dichloropropene	25000	U
71-43-2	Benzene	5000	J
107-06-2	1,2-Dichloroethane	25000	U
79-01-6	Trichloroethene	25000	U
78-87-5	1,2-Dichloropropane	25000	U
74-95-3	Dibromomethane	25000	U
75-27-4	Bromodichloromethane	25000	U
10061-01	cis-1,3-Dichloropropene	25000	U
108-88-3	Toluene	8800	J
10061-01	trans-1,3-Dichloropropene	25000	U
79-00-5	1,1,2-Trichloroethane	25000	U
127-18-4	Tetrachloroethene	25000	U
142-28-9	1,3-Dichloropropane	25000	U
124-48-1	Dibromochloromethane	25000	U
106-93-4	1,2-Dibromoethane	25000	U
108-90-7	Chlorobenzene	25000	U
630-2-6	1,1,1,2-Tetrachloroethane	25000	U
100-41-4	Ethylbenzene	25000	U
1330-20-7	Xylene (para & meta)	25000	U
1330-20-7	Xylene (Ortho)	25000	U
100-42-5	Styrene	25000	U
75-25-2	Bromoform	25000	U
98-82-8	Isopropylbenzene	25000	U

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

Sample

4371-2

Lab Name: ENVIROGEN Analyst: AS

NJ DEP#: 11001 Calib date 11/17/00 GC/MS: Inst #2 Client: NA

Matrix: (soil/water) SOIL Lab Sample ID: 4371-2 0.010ml

Sample wt/vol: 5.0 (g/ml) G Lab File ID: S2004.D

Level: (low/med) MED Date Received: 10/24/00

% Moisture: not dec. 0 Date Analyzed: 11/21/00

GC Column: rt502.2 ID: 0.25 (mm) Dilution Factor: ~~1.0~~ 5,000 PR

Soil Extract Volume: 25 (uL) Soil Aliquot Volume: 0.01 (uL)

CONCENTRATION UNITS: (ug/L or ug/Kg) UG/KG

CAS NO.	COMPOUND	UG/KG	Q
108-86-1	Bromobenzene	25000	U
79-34-5	1,1,2,2-Tetrachloroethane	25000	U
96-18-4	1,2,3-Trichloropropane	25000	U
106-65-1	n-Propylbenzene	50000	U
95-49-8	2-Chlorotoluene	50000	U
106-43-4	4-Chlorotoluene	50000	U
108-67-8	1,3,5-Trimethylbenzene	25000	U
98-06-6	tert-Butylbenzene	25000	U
95-63-6	1,2,4-Trimethylbenzene	25000	U
135-98-8	sec-Butylbenzene	50000	U
541-73-1	1,3-Dichlorobenzene	25000	U
99-87-6	4-Isopropyltoluene	50000	U
106-46-7	1,4-Dichlorobenzene	25000	U
95-50-1	1,2-Dichlorobenzene	25000	U
14-51-8	n-Butylbenzene	50000	U
96-12-8	1,2-Dibromo-3-chloropropane	25000	U
120-82-1	1,2,4-Trichlorobenzene	25000	U
87-68-3	Hexachlorobutadiene	50000	U
91-20-3	Naphthalene	25000	U
87-61-6	1,2,3-Trichlorobenzene	25000	U
1634-04-4	MTBE	25000	U
67-64-1	Acetone	69000	
75-15-0	Carbon disulfide	25000	U
78-93-3	2-Butanone (MEK)	120000	
109-99-9	Tetrahydrofuran (THF)	50000	U
591-78-6	2-Hexanone	50000	U
110-75-8	2-Chloroethyl vinyl ether	50000	U

1E
VOLATILE ORGANICS ANALYSIS DATA SHEET
TENTATIVELY IDENTIFIED COMPOUNDS

Sample: **4371-2**

Lab Name: ENVIROGEN Analyst: AS

NJ DEP#: 11001 Calib date 11/17/00 GC/MS: Inst #2 Client: NA

Matrix: (soil/water) SOIL Lab Sample ID: 4371-2 0.010ml

Sample wt/vol: 5.0 (g/ml) G Lab File ID: S2004.D

Level: (low/med) MED Date Received: 10/24/00

% Moisture: not dec. 0 Date Analyzed: 11/21/00

GC Column: rt502.2 ID: 0.25 (mm) Dilution Factor: ~~1.0~~ 5,000 PK

Soil Extract Volume: 25 (uL) Soil Aliquot Volume: 0.01 (uL)

CONCENTRATION UNITS:
(ug/L or ug/Kg) UG/KG

Number TICs found: 1

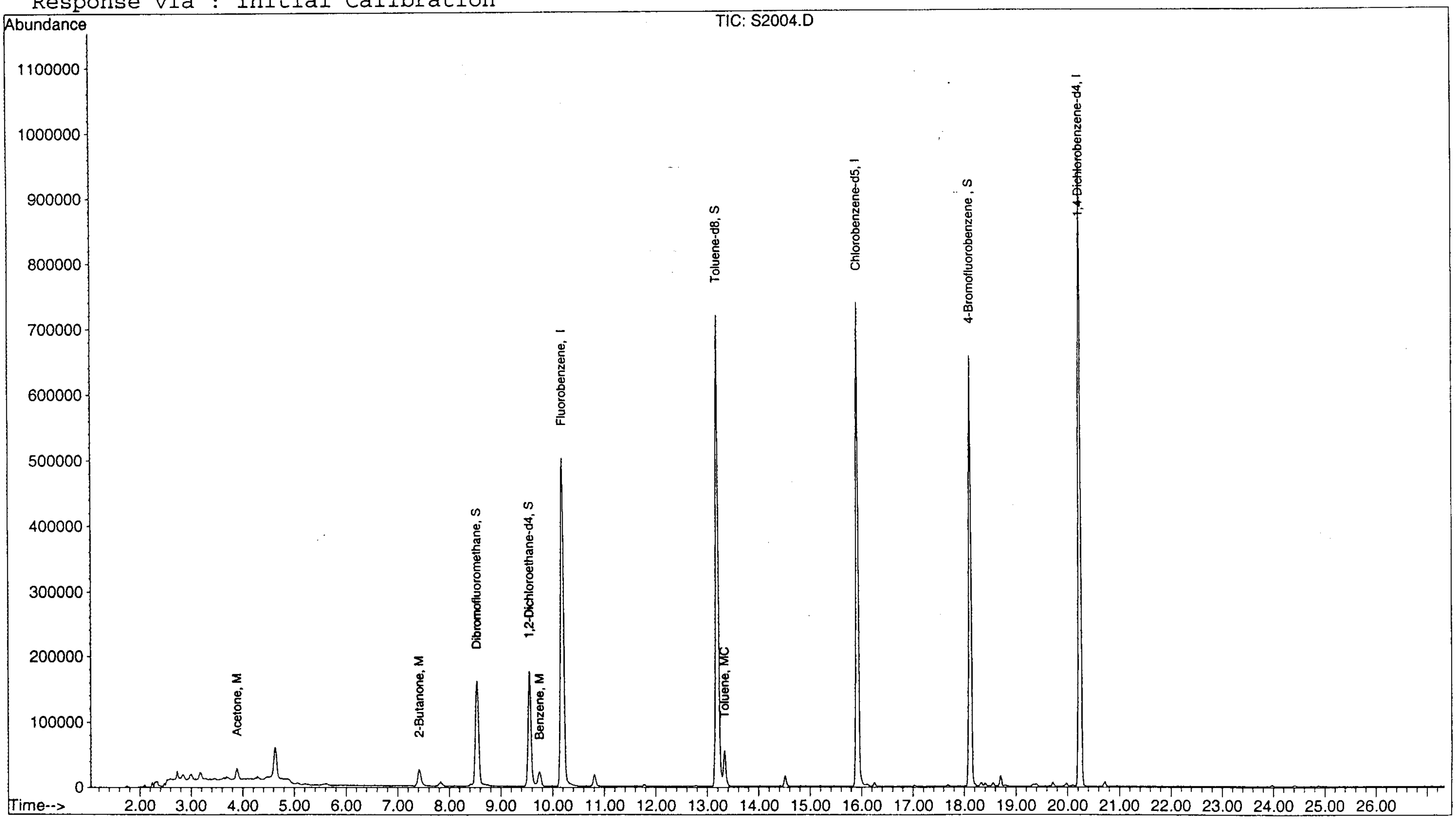
CAS NO.	COMPOUND NAME	RT	EST. CONC.	Q
1. 000079-20-9	Acetic acid, methyl ester	4.63	13000	JN

Data File : C:\HPCHEM\1\DATA\112100\S2004.D
Acq On : 21 Nov 2000 6:46 pm
Sample : 4371-2 0.010ml(5g-25ext)
Misc :
MS Integration Params: ODD.P
Quant Time: Dec 5 11:12 2000

Vial: 7
Operator: TS
Inst : GC/MS Ins
Multiplr: 1.00

Quant Results File: 5971VOA.RES

Method : C:\HPCHEM\1\METHODS\5971VOA.M (RTE Integrator)
Title : EPA Method 8260A
Last Update : Fri Nov 17 12:04:52 2000
Response via : Initial Calibration



1A
VOLATILE ORGANICS ANALYSIS DATA SHEET

Sample
4371-2

Lab Name: ENVIROGEN   Analyst: AS

NJ DEP#: 11001   Calib date 11/17/00   GC/MS: Inst #2   Client: NA

Matrix: (soil/water) SOIL   Lab Sample ID: 4371-2 0.020ml

Sample wt/vol: 5.0 (g/ml) G   Lab File ID: S2010.D

Level: (low/med) MED   Date Received: 10/24/00

% Moisture: not dec. 0   Date Analyzed: 11/22/00

GC Column: rt502.2 ID: 0.25 (mm)   Dilution Factor: ~~1.0~~ 2500 PA

Soil Extract Volume: 25 (uL)   Soil Aliquot Volume: 0.02 (uL)

CONCENTRATION UNITS:

CAS NO.	COMPOUND	(ug/L or ug/Kg) UG/KG	Q
74-75-8	Dichlorodifluoromethane	25000	U
74-87-3	Chloromethane	12000	U
75-01-4	Vinyl chloride	12000	U
74-83-9	Bromomethane	12000	U
75-00-3	Chloroethane	12000	U
75-69-4	Trichlorofluoromethane	25000	U
75-35-4	1,1-Dichloroethene	12000	U
75-09-2	Methylene chloride	12000	U
156-60-5	trans-1,2-Dichloroethene	12000	U
75-34-3	1,1-Dichloroethane	12000	U
594-20-7	2,2-Dichloropropane	12000	U
156-60-5	cis-1,2-Dichloroethene	12000	U
74-97-5	Bromochloromethane	12000	U
67-66-3	Chloroform	12000	U
71-55-6	1,1,1-Trichloroethane	12000	U
56-23-5	Carbon tetrachloride	12000	U
563-58-6	1,1-Dichloropropene	12000	U
71-43-2	Benzene	5400	J
107-06-2	1,2-Dichloroethane	2600	J
79-01-6	Trichloroethene	12000	U
78-87-5	1,2-Dichloropropane	12000	U
74-95-3	Dibromomethane	12000	U
75-27-4	Bromodichloromethane	12000	U
10061-01	cis-1,3-Dichloropropene	12000	U
108-88-3	Toluene	8800	J
10061-01	trans-1,3-Dichloropropene	12000	U
79-00-5	1,1,2-Trichloroethane	12000	U
127-18-4	Tetrachloroethene	12000	U
142-28-9	1,3-Dichloropropane	12000	U
124-48-1	Dibromochloromethane	12000	U
106-93-4	1,2-Dibromoethane	12000	U
108-90-7	Chlorobenzene	12000	U
630-2-6	1,1,1,2-Tetrachloroethane	12000	U
100-41-4	Ethylbenzene	12000	U
1330-20-7	Xylene (para & meta)	12000	U
1330-20-7	Xylene (Ortho)	12000	U
100-42-5	Styrene	12000	U
75-25-2	Bromoform	12000	U
98-82-8	Isopropylbenzene	12000	U

1A

VOLATILE ORGANICS ANALYSIS DATA SHEET

Sample

4371-2

Lab Name: ENVIROGEN Analyst: AS

NJ DEP#: 11001 Calib date 11/17/00 GC/MS: Inst #2 Client: NA

Matrix: (soil/water) SOIL Lab Sample ID: 4371-2 0.020ml

Sample wt/vol: 5.0 (g/ml) G Lab File ID: S2010.D

Level: (low/med) MED Date Received: 10/24/00

% Moisture: not dec. 0 Date Analyzed: 11/22/00

GC Column: rt502.2 ID: 0.25 (mm) Dilution Factor: ~~1.0~~ 2500 PL

Soil Extract Volume: 25 (uL) Soil Aliquot Volume: 0.02 (uL)

CONCENTRATION UNITS:

CAS NO.	COMPOUND	(ug/L or ug/Kg) UG/KG	Q
108-86-1	Bromobenzene	12000	U
79-34-5	1,1,2,2-Tetrachloroethane	12000	U
96-18-4	1,2,3-Trichloropropane	12000	U
106-65-1	n-Propylbenzene	25000	U
95-49-8	2-Chlorotoluene	25000	U
106-43-4	4-Chlorotoluene	25000	U
108-67-8	1,3,5-Trimethylbenzene	12000	U
98-06-6	tert-Butylbenzene	12000	U
95-63-6	1,2,4-Trimethylbenzene	12000	U
135-98-8	sec-Butylbenzene	25000	U
541-73-1	1,3-Dichlorobenzene	12000	U
99-87-6	4-Isopropyltoluene	25000	U
106-46-7	1,4-Dichlorobenzene	12000	U
95-50-1	1,2-Dichlorobenzene	12000	U
14-51-8	n-Butylbenzene	25000	U
96-12-8	1,2-Dibromo-3-chloropropane	12000	U
120-82-1	1,2,4-Trichlorobenzene	12000	U
87-68-3	Hexachlorobutadiene	2700	J
91-20-3	Naphthalene	12000	U
87-61-6	1,2,3-Trichlorobenzene	12000	U
1634-04-4	MTBE	12000	U
67-64-1	Acetone	71000	
75-15-0	Carbon disulfide	12000	U
78-93-3	2-Butanone (MEK)	150000	
109-99-9	Tetrahydrofuran (THF)	25000	U
591-78-6	2-Hexanone	25000	U
110-75-8	2-Chloroethyl vinyl ether	25000	U

1E

VOLATILE ORGANICS ANALYSIS DATA SHEET

TENTATIVELY IDENTIFIED COMPOUNDS

Sample

4371-2

Lab Name: ENVIROGEN Analyst: AS

NJ DEP#: 11001 Calib date 11/17/00 GC/MS: Inst #2 Client: NA

Matrix: (soil/water) SOIL Lab Sample ID: 4371-2 0.020ml

Sample wt/vol: 5.0 (g/ml) G Lab File ID: S2010.D

Level: (low/med) MED Date Received: 10/24/00

% Moisture: not dec. 0 Date Analyzed: 11/22/00

GC Column: rt502.2 ID: 0.25 (mm) Dilution Factor: ~~1.0~~ 2500 AR

Soil Extract Volume: 25 (uL) Soil Aliquot Volume: 0.02 (uL)

CONCENTRATION UNITS:

(ug/L or ug/Kg) UG/KG

Number TICs found: 3

CAS NO.	COMPOUND NAME	RT	EST. CONC.	Q
1. 000079-20-9	Acetic acid, methyl ester	4.62	15000	JN
2. 000107-87-9	2-Pentanone	10.79	3900	JN
3. 000123-86-4	Acetic acid, butyl ester	14.50	3300	JN

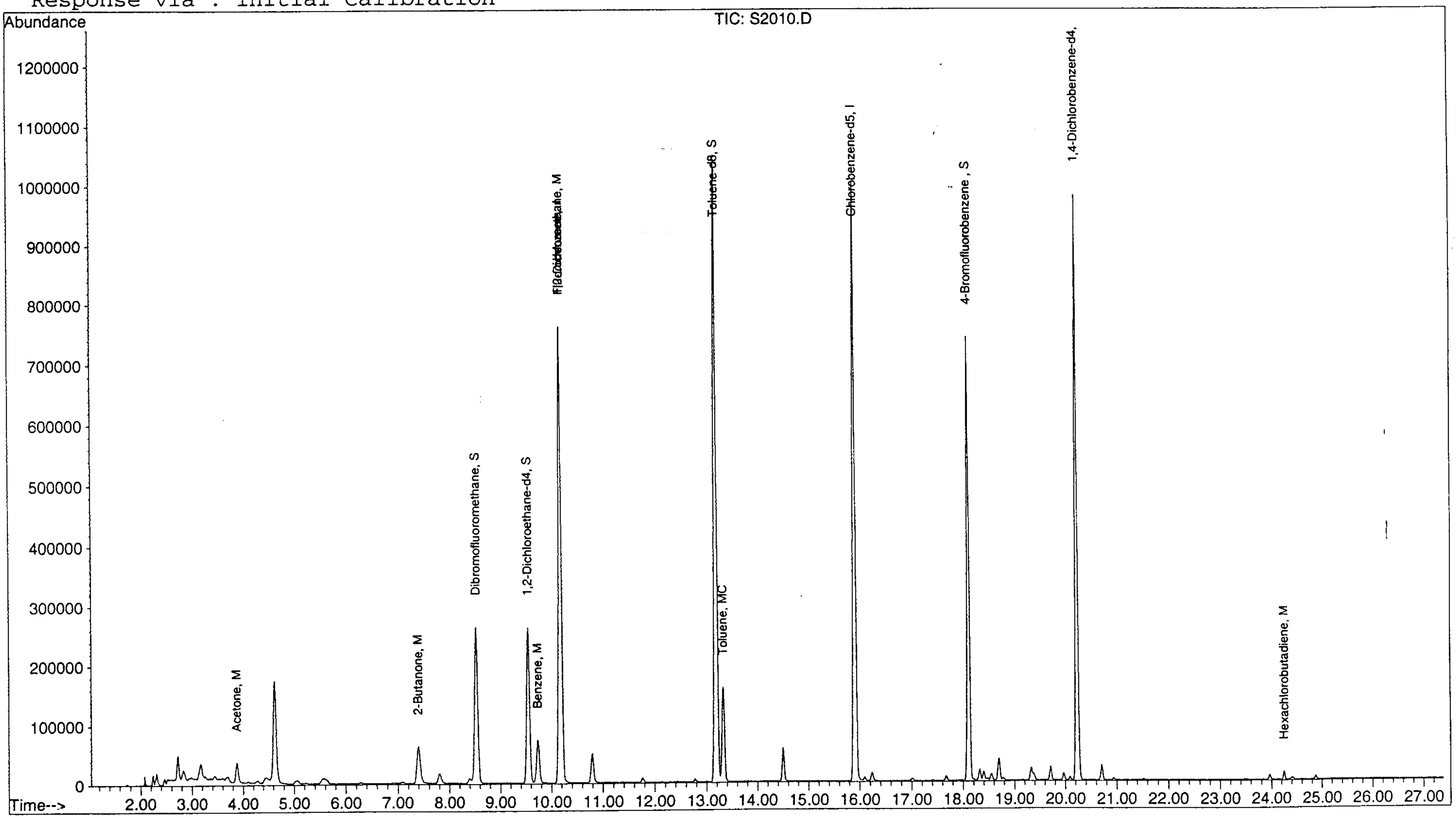
Quantitation Report

Data File : C:\HPCHEM\1\DATA\112200\S2010.D
Acq On : 22 Nov 2000 9:28 pm
Sample : 4371-2 0.020ml
Misc :
MS Integration Params: ODD.P
Quant Time: Dec 5 11:24 2000

Vial: 12
Operator: TS
Inst : GC/MS Ins
Multiplr: 1.00

Quant Results File: 5971VOA.RES

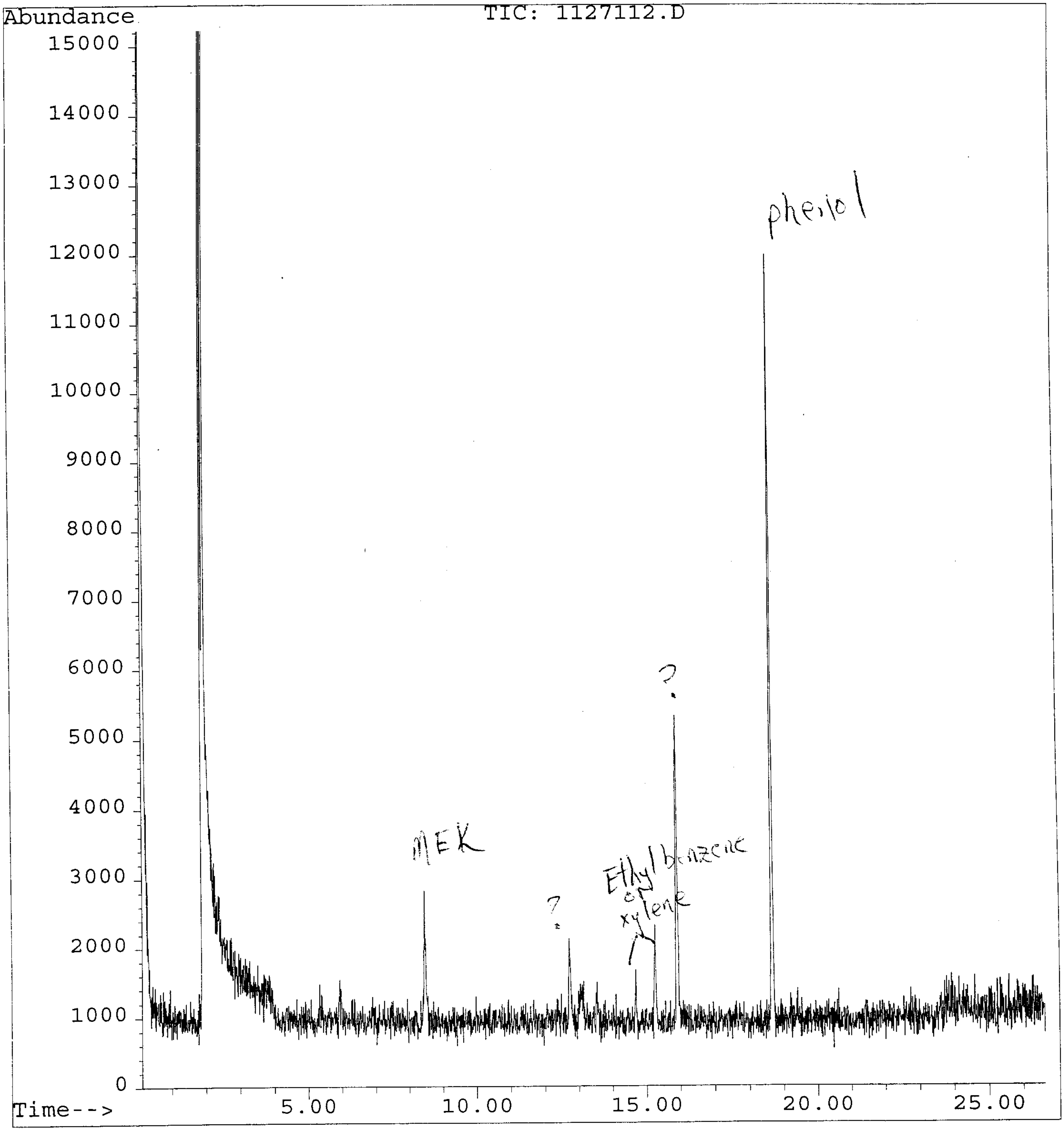
Method : C:\HPCHEM\1\METHODS\5971VOA.M (RTE Integrator)
Title : EPA Method 8260A
Last Update : Fri Nov 17 12:04:52 2000
Response via : Initial Calibration



APPENDIX E

LABORATORY ANALYSIS OF BIOFILTER AIR

File : C:\HPCHEM\1\DATA\1127112.D
Operator :
Acquired : 25 Nov 100 1:50 pm using AcqMethod VOC-SPME
Instrument : 5971 - In
Sample Name: envirogen biofilter 2 carboxen
Misc Info :
Vial Number: 1



APPENDIX F

COST INFORMATION AND CALCULATIONS

Concentrator-Regenerator/Biofilter

Concentrator-Regenerator						
Discount Rate	0.12					
Year	0	1	2	3	4	5
Cost (1998)	$ 804,500	$ 68,700	$ 68,700	$ 68,700	$ 68,700	$ 68,700
O&M (Inflation)	$ 804,500	$ 71,448	$ 74,306	$ 77,278	$ 80,369	$ 83,584
NPV per Year	$ 804,500	$ 63,793	$ 59,236	$ 55,005	$ 51,076	$ 47,428
Total NPV	**$ 1,081,038**					
Biofilter						
Discount Rate	0.12					
Year	0	1	2	3	4	5
Cost (1998)	$ 70,700	$ 5,580	$ 5,580	$ 5,580	$ 5,580	$ 5,580
O&M (Inflation)	$ 70,700	$ 5,803	$ 6,035	$ 6,277	$ 6,528	$ 6,789
NPV per Year	$ 70,700	$ 5,181	$ 4,811	$ 4,468	$ 4,149	$ 3,852
Total NPV	**$ 93,161**					
Concentrator-Regenerator/Biofilter						
Discount Rate	0.12					
Year	0	1	2	3	4	5
Cost (1998)	$ 875,200	$ 74,280	$ 74,280	$ 74,280	$ 74,280	$ 74,280
O&M (Inflation)	$ 875,200	$ 77,251	$ 80,341	$ 83,555	$ 86,897	$ 90,373
NPV per Year	$ 875,200	$ 68,974	$ 64,048	$ 59,473	$ 55,225	$ 51,280
Total NPV	**$ 1,174,199**					